# SCIENTIFIC AMERICAN

*The Monthly Journal of Practical Information*

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DE FLIGHT CONDITIONS IN THE LOW-PRESSURE CAISSON.—[See page 401.]

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# With the Editors

THERE are many toes to be stepped on in technical journalism. In almost any article which has any pretensions to giving real information, there is generally some statement which gives rise to a protest from some unexpected direction. If we say that the thing is white, someone rises to correct us and say that it is black, and that, furthermore, by our statement to the effect that the thing is white, we have committed a grave injustice to this someone and have caused him a serious loss of business. It goes without saying that an immediate retraction of the original statement is demanded, plus more or less gratis-free-for-nothing publicity to heal the metaphorical wound.

IT is surprising how much controversy exists in this world of ours. No one realizes this condition of affairs more than the technical journalist, who is constantly being brought face to face with controversial matters. And if the technical journalist wishes to be unbiased and fair to everyone, he finds plenty of additional work to keep himself occupied. If he prepares an elaborate article on some new invention, he is immediately confronted by the statements and arguments of those whose business is bound to suffer from the introduction of this new invention. Indeed, to please everyone concerned, it would be necessary to publish two separate accounts of every technical advance—one dealing with what the advocates would like to read and the other with what the antagonists would like to read. Perhaps it would be better even to publish two separate editions, one for the advocates, and the other for the antagonists. A further improvement on existing methods of publishing would be to send a plain edition, containing nothing but blank pages for the subject in question, to the average, disinterested reader, so that he might not be led astray one way or another!

BUT then there are times when the technical journalist is really at fault. Despite the utmost care in gathering facts and in weaving them into an interesting yet disinterested account, misstatements of fact will sometimes creep into our columns. The editorial mind is always keen and alert for possible misstatements in articles contributed by outside writers; in truth, writers are relied upon for accurate facts only after they have established a reputation for accuracy, and they are immediately cast into disfavor when they are found to be inaccurate. The SCIENTIFIC AMERICAN has long prided itself on its editorial accuracy. But for all that, mistakes occasionally creep into our columns. When they do, they are soon called to our attention by our very observing and well-posted readers. And in a spirit of fair play, as well as a desire to give the authentic information, we are always ready to acknowledge and correct such mistakes.

OUR Abrams investigation and our psychic investigation are in full swing. In this issue will be found the results of another test sitting with an independent writing medium, together with the report of our committee, as well as the comments and suggestions regarding our first electronic reactions test, which was reported in the November issue. Never have we dealt with a subject that aroused such interest as the Abrams investigation. Letters are coming in from all parts of the country. We are hearing from orthodox doctors, who in some instances condemn us for devoting any attention to the extravagant claims of electronic technique, and in yet others compliment us for our initiative. Then there are letters from electronic practitioners, who are equally complimentary and anxious that we examine the matter thoroughly, so that their remarkable claims may be substantiated. This investigation, according to present signs, is not going to be an easy one. It is going to take time. It will require much patience. A plan of campaign has been laid out which takes into consideration the establishing of the more elementary facts before proceeding to the more involved; and, at intervals, certain check backs to verify our sum total of findings.

IN an investigation such as ours we must work entirely with first-hand information. We welcome letters giving experiences with the electronic diagnosis and treatment; we welcome reports from doctors and electrical research workers and others who have conducted tests of their own with the technique and the apparatus involved; we welcome suggestions from Dr. Abrams and his vast number of students and workers. Already we have a vast amount of such material on hand. Still, in the final analysis, it will be the facts which we obtain ourselves from face-to-face contact with the entire subject matter which will swing the decision of our committee.

OUR next issue, carrying the January date, is to be largely devoted to the automotive industry. It comes at that time of the year when virtually all the automobile manufacturers have announced their new offerings of the season, and when the average man is giving some thought to his next car. Perhaps its most significant feature will be the price chart, which will give at a glance the story of each type of automobile and motor truck then on the market. This chart, representing a compilation of a large volume of data gathered from the makers, will give the number of cylinders, the horsepower, wheel base, tire size, and price. Thus the reader will have before him in tabloid form the entire story of the current automotive industry, and, with a given amount of money to spend on a car he will be in a position to invest that money to the best possible advantage.

THE new four-wheel brakes and the "balloon" tires will be discussed, along with the several innovations in engine design, automatic gear shifting, etc. The problem of proper lubrication both for the engine and for the chassis will receive special consideration, for it is a proved fact that repair bills are largely based on insufficient lubrication.

THEN there is that major problem of motordom—the highway problem. What with hundreds of thousands of new cars being introduced each year, in addition to millions of old cars which are still a long ways from the scrap heap, the highway situation is becoming serious. Our motor laws are fast becoming hopelessly obsolete. The inter-state tourist has brought about an urgent demand for the standardization of laws throughout this broad land of ours. Accidents due to careless driving, headlight glare and other causes complicate automobile legislation still further. All of which comes in for due consideration in our January issue, which will be the opening gun of our campaign to solve the highway problem.

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SEVENTY-NINTH YEAR

# SCIENTIFIC AMERICAN

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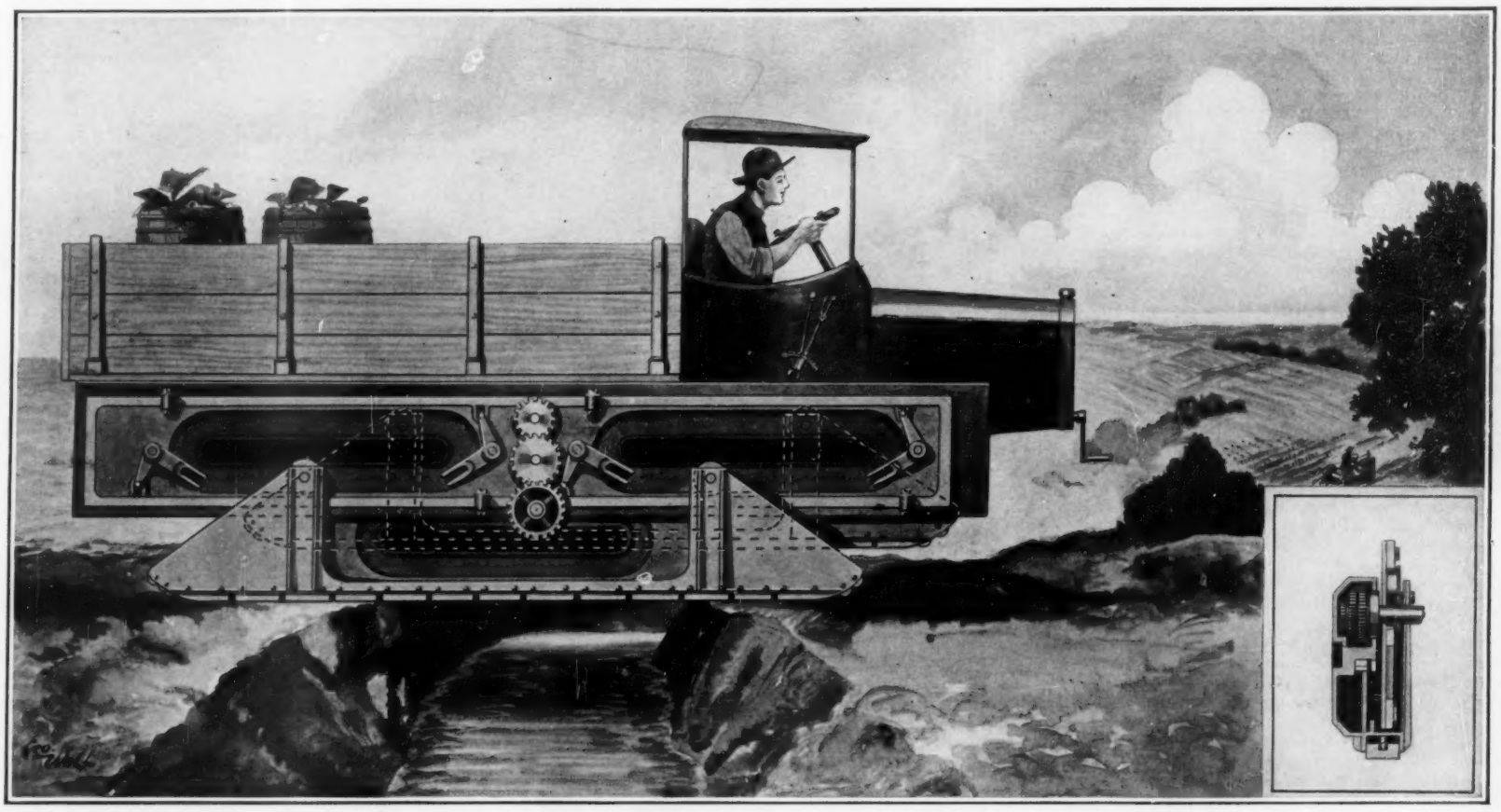


## A Wheelless Motor-Car

*By Dr. Alfred Gradenwitz*

THE designing of motor cars moving on runners instead of on wheels is no absolute novelty in itself. In fact, on perusing the annals of patent offices many examples of schemes such as this could be found, though none of them has got beyond an experimental stage. It was left to a Berlin inventor, R. Venzlaff, to perfect the first full-size vehicle of the wheelless type, and as the writer has had the good fortune to inspect it in actual operation, the account given in the following does not tell what is planned for the future, but what has actually been achieved and already is in being.

The new vehicle comprises two pairs of runners three meters long, which, like the four feet of a horse are alternately raised and lowered, the runners of each pair, the outer as well as the inside one, being rigidly connected with one another. Supposing the underframe and body of the vehicle to rest on both pairs of runners, the engine will at first lift the two outer runners, leaving the car to rest on the inside pair; and, after moving it forward a certain distance (1.3 meters), will put them down on the soil, in order, immediately afterwards, to commence the same operation with the inside runners.

The main difficulty met with in connection with any previous attempt to solve the problem was that the pair of runners temporarily lifted from the ground could not be lowered quickly enough, and placed in front of the underframe, to enable the latter to move along uninterruptedly and without a hitch. This is for the first time realized in the new vehicle, where the pair of runners temporarily raised from the ground move forward past the underframe at a more rapid rate than that at which the latter will presently glide across the pair of runners happening to rest on the ground. Inasmuch as the runners actually constitute rails on which the rollers carrying the underframe are gliding, the consumption of energy is extremely low. Actual tests have shown a load of 6 to 8 tons to be conveyed by the vehicle driven by a low-power engine (25 horsepower) at a relatively high speed, viz., 8 to 10 kilometers per hour, irrespective of any obstacle, *e.g.*, tree-trunks lying on the road. The vehicle, as it were, throws a bridge across ditches, which accordingly are traversed with greatest ease; it will readily negotiate even considerable gradients. Inasmuch as the weight of the engine is of no importance, crude oil engines can largely be used for driving this type of vehicle, thus reducing considerably the working expenses. Entire trains can be formed of such vehicles, though only the front vehicle need be power-driven.

The vehicle is without any exertion and without the aid of any complicated mechanism steered from the driver's seat by means of a hand-wheel altering at will the angle between the two sets of runners. Any curve can thus be readily described, the vehicle being even turned on the spot, without any forward or backward motion. The step of the car is under way altered at will between the normal figure of 1.30 meter and zero, thus enabling heavy gradients to be readily negotiated.

While the cost of construction of the vehicle is only immaterially in excess of that of ordinary trucks, the wear and tear are reduced to a minimum, there being no friction or slipping on the ground. The vehicle will be found especially useful on impracticable ground, on soil to be brought under cultivation.

### Charles Proteus Steinmetz

JUST as we are going to press, and too late either for preparation of an extended obituary or for the accommodation of such a notice in our pages already made up, comes the news of the death of America's best known engineer. Dr. Steinmetz was born in Germany in 1865, and received a good education. His Socialist proclivities forced him to flee the country, and he came to the United States, without funds and with slight knowledge of our language, in 1889. He secured work as a draftsman under an environment that gave ample scope for his natural designing and engineering ability, and his rise to the top of the electrical engineering profession was rapid. He soon came into the employ of the General Electric Co., and for many years prior to his death his name was synonymous with the extraordinary development of organized research and the magnificent laboratory maintained by that company at Schenectady. Among his peers, he was recognized as the foremost exponent of the union of mathematics and electricity. He was responsible for the modern mathematical treatment of all alternating current problems, and Edison characterizes him as the world's greatest practical mathematician. To the general public he was probably best known for his high-voltage experiments.

# With Fire and Fraud

## Something About the Acquisitive Gentleman Who Burns Buildings for Profit

*By Edward H. Smith*

IN THE fall of 1753, Captain John Lancey was ordered to proceed from Biddeford to the Colony of Maryland, with a ship full of brickbats. He raised his hook and sail, dropped lazily down the desultory Torridge and headed into the mysterious West, that region of red wild men and undreamed malevolence. At sundown the young skipper stood on his bridge quaking over the strange emprise that held him, looking forward toward the Colonies he would never see and back at his England, fading in distance and dusk.

At 8 o'clock there was an explosion below decks. The upper parts of the vessel fired like straw. Below decks the inexorable sea flowed in, through a great gash the powder had opened in her belly. The cargo of bricks bore her swiftly down. No pumps might hope to keep such a wreck afloat till dawn.

After some agonies, Captain Lancey got the boat launched and all hands safely aboard. They reached England the following day and Lancey reported to his brother-in-law and employer, one Benson, then sitting in Parliament for Barnstaple. Benson sent his captain to a proctor, before whom the mariner swore that the firing had been accidental and that nothing could have availed to save the ship or her cargo. Benson left England for a tour—and Lancey stayed behind.

A little later, through the tattle of some idle tongue, the captain and his rich relative became suspect and investigation showed that Benson had laden his ship with a cargo of merchandise for America, insured the vessel and her contents for twice the honest value and later secretly had the goods removed and the ship filled with bricks for ballast. He commanded Captain Lancey to take her out to sea and set her afire. The young man declined until his relative pointed out to him that it was within the latter's power to discharge and beggar the seaman. Then Lancey complied, setting fire to his own ship under his feet by means of an explosive mechanism which rapidly spread the fire.

A few sentences from that treasure house of bitterest recollections, Camden Pelham's "New Newgate Calendar," will complete this tale of early commercial arson:

"His employer . . . fled . . . and his unhappy dupe being brought to trial, was capitally convicted and received sentence of death. He subsequently lay in prison for about four months, during which time he pursued his devotional exercises with the utmost regularity, and was hanged on the 7th June, 1754, at Execution Dock, in the 27th year of his age."

If I recall this old crime and melancholy destination it is surely not to hold poor John Lancey in a piteous extension of impure memory or to expose his name to further obloquy, for he was, as the Newgate Calendar grievously notes, respectably connected and even gently born. My purpose is rather to show the antiquity of arson for profit, a kind of crime now offering both the police and the inventors of this and every country one of their most sore afflictions. The suggestion is not that John Lancey was the first man to burn a house or a ship to get the insurance. Indeed, this crime must be as old as insuring, which is not much younger than trading. Commercialized fire insurance sprang up after the great London fire of 1666, though the guilds had provided similar protection much earlier; and, more than likely, Shakespeare's Antonio came into dour Shylock's grip through the need of a premium for marine insurance—to cover those delayed "argosies in Tripolis, India and Mexico." So, Lancey is but a reminder.

In beginning to write of fire as a criminal instrument, some ironies and strangenesses are to be noted: Fire, the one pure element of the ancients, employed for foul impurities; fire, the source of light, in the service of the forces of darkness; fire, the great reagent of the alchemists, by which man was to gain the secret of high fortune and lasting life, used to spread misery and death; the deep-searching flame of Hermes Trismegistus, Zosimus of Panopolis and Paracelsus Hohenheim in the hands of Benny-the-Bake and the Firebug Kid!

The historic conflict between man and his Promethean friend and Satanic enemy began in the bone-strewn grottoes where the dawn-man gnawed the joints of his roasted prey, or in the vanished forests that burned and consumed wandering tribes of hunters in ages forgotten and lost. It continues in the age of concrete and steel. To guard against this foe-friend, men have made ten thousand experiments and inventions, meantime employing him for their power and their researches.

In so brief an article it is possible to mention only a few of the important inventions which men have wrought to protect themselves against fire in its destructive mood. When this writer was a child he was taken to a building in Chicago where a great fire had been set in one of the rooms and permitted to burn for hours as a demonstration of the first fireproof hotel. Somewhat later, also in Chicago, a theater disaster brought

**Firemen working on an incendiary fire in a city dwelling house**

about the installation of asbestos curtains in theaters and the general adoption of fireproof construction. Since that day many other installations have been made—all-steel railroad coaches and sleeping cars; great buildings without an ounce of inflammable material in their structures; automatic sprinkler systems for flooding buildings with water at the first outbreak of fire; other automatic systems which sound alarms when any fire breaks out; steel, glass and porcelain office furniture; special insulation to provide against fire from electric wiring, etc. In spite of all these improvements and steps of progress, America remains worse afflicted with fire losses than any other western land, a curious fact when one brings to mind the old cities of Europe, with their narrow cluttered streets, their lack of fire fighting apparatus and the dry mould of their centuries.

Just why fires should be so prevalent in America is difficult to say. Authorities disagree and flounder. All we can know definitely is that a tremendous struggle is in progress in this country between destructive fire and the agencies of defense and preservation. Fire insurance companies have naturally taken a leading part in this effort to reduce the fire loss. Their strength has been expended mainly in combatting the accidental fire, the fruit of carelessness, forgetfulness and stupidity in man.

But there is a far deeper and darker struggle than this going on between civilization and withering fire. Like every other tool which honest men have used for the advancement of civilization and social order, fire has been and is being used every day by criminals. Poor John Lancey is abroad in the land, converted into a professional fire setter, an arson specialist. He is in all communities. His ruins monument every townsite in the land.

The story of the fire-setter is of itself an old and stale one. Purposeful fires among merchants became a common jest before the birth of any man now living. We all know how old and simple a thing it is to insure a $5,000 stock for $8,000 and shortly set the match. But such tricks have become more and more difficult since the insurance companies and the various associations of creditors have come to realize their own peril and the methods of fire setters. Insurance investigations are now reasonably rigid, whereas they were once pitifully lax. The action of creditors is, in this day, remarkably swift and consecutive. It used to be slow and easily exhausted. In brief, the firebugs are now being resisted and punished. The result of such action has not been to drive them out of business, but to sharpen their wits and stimulate their inventive faculties. How to set a fire and not be caught at it? This is the chief preoccupation of a large and growing class of criminals against whom no really effective measures have yet been developed.

The rationale of commercial arson needs to be understood. It has often been said that firing seldom figures in fake bankruptcy cases. The truth is otherwise. If a crooked merchant wants to go fraudulently broke and thus cheat his creditors, he must get rid of his goods somehow. To remove and hide them, thereafter claiming bankruptcy, is the simple course, but a search is always made. Many crooked merchants consider it far cleverer technique to burn out their nearly empty stores after the valuable part of the stock has been secreted. In that case the creditors seize the insurance money, but what matter to the thief? He has his goods. Why should he care if the loss is shifted from the shoulders of those who trusted him to the backs of those who insured him? Moreover, there is always the older device of over-insuring. In that case the creditors get what's coming to them and the burnt-out merchant takes the balance, plus the hidden merchandise. In still other cases, no creditors figure. The arsonist has simply disposed of his paid-for goods and then burnt out his shell of a store.

In every case where arson is committed the problem of safety for the criminal plays a leading part. How to set a fire that will burn so swiftly and hotly as to destroy all evidences of arson before the fire fighters can possible quench it? How to touch off a fire when the persons interested in the insurance are demonstrably far away? How to do this without the employment of untrustworthy intermediaries? There are the questions which always face the fire setter. How he meets them is the heart of this article.

I am indebted for much of my material to that most eminent authority on arson and credit frauds, Mr. C. D. West, at present chief investigator for the National Association of Credit Men. Mr. West has run to ground more expert arsonists and solved more strange fire mysteries than any other detective officer now living, and accordingly occupies a special position in the world of crime suppression.

One of the recent devices employed by mercantile fire setters was recovered from a store in downtown New York not long ago when a watchman in the building made an unwelcome intrusion and found the infernal machine before it had had time to do its work. It consisted of the shallow round top of a butter tub. This wide inch-deep saucer had been filled with cotton wool impregnated with petroleum or gasoline. In the center of this inflammable mass stood a short piece of candle, which was burning when the thing was found. To the

outer edge of the saucer had been tacked twelve or fifteen little upright pieces, the top of each supporting a small bladder of very thin rubber. Each of these little bladders was filled with five or six ounces of gasoline and tied shut securely. Similar fire machines have been found in which one or two cow's bladders had been used, each laden with three to four quarts of the popular motor fuel.

The theory of this mechanism is simple enough. The candle in the center had been cut to a length which would burn for nine or ten hours before reaching the oil soaked cotton wool. It had been lighted at six o'clock, when the proprietor of the shop had closed his door and gone home for the night. It would do its deadly work between three and four o'clock in the morning. As soon as the candle burned itself short enough to set off the cotton there would be a considerable flame. This would heat the gasoline in the little bladders. In a few minutes the expanding gas would burst the bladders and throw the flaming gasoline to all parts of the store. Flame would thus spring up in a score of places at once and the explosion would surely destroy all vestige of the mechanism. To make sure of the work's success, the floor had been soaked with gasoline at various points and the part of the store nearest the pyrotechnic mechanism had been heavily draped with kimonos, lace curtains and other highly inflammable materials. In this single case the firebug failed. In how many others of the sort did he succeed!

In one of the upstate cities of New York, not long ago, an Italian grocer and general merchant occupied the ground floor of a frame building. An outside stairway ran to the second floor, where a Syrian artist lived with his wife and children. In the basement of the premises was an old fashioned hot-air furnace, the pipes from which ran to registers in both floors.

A little after eleven o'clock, on a cold night last winter, the wife of the Syrian living in the upper story awoke from sound sleep and smelled a strong odor of gasoline. She hesitated for a few minutes, but as the odor grew in heaviness, she threw on her clothes and started for her husband who was at a lodge meeting two or three squares away. Just as she opened the door he came in and recoiled from the gas. He went downstairs immediately and, not without some suspicion, forced his way into the Italian's grocery store. Just as he did so, he saw a shadowy figure retreat to the alley and drive off in a motor car, which had been standing close by with lamps out.

Inside the store the Syrian found a five-gallon water cooler standing on a shelf, with the spigot turned so slightly open that the contents dripped from it drop after drop. Underneath this device were piled two cases of parlor matches with a gross of large boxes in each. These matches were already swimming in the gasoline dripping from the water cooler. In the center of the floor stood two galvanized tubs which were half filled with gasoline. Not less than twenty gallons of this hideous inflammable had been provided for the fire.

The Syrian turned off the gasoline dripping faucet of the cooler, opened the doors and windows to allow the exhalation of the gas and set off for the Italian's home, some distance away. To his intense surprise, he found a celebration going on. The Italian's baby son was being christened, and among the guests at the party were the chief of police, some other city officials and some politicians, among whom the Italian grocer ranked himself. The grocer tried to put the Syrian off. First he said the thing could be of no importance and that he would not leave his baby's christening because a little oil was leaking. Then he said he had given the keys to the baby and they had been lost. Finally, the irate Syrian appealed to the police chief and that official decided that his public duty was somewhat more urgent than his social obligation. He entered the shop, found the saturated matches, the water cooler still half full of gasoline, the tubs of inflammable liquid on the floor and a general arrangement of materials for a quick, disastrous fire.

Undoubtedly, had the Syrian and his family been in their beds on the upper floor when the crash came, they would have been blown to kingdom come. The Italian had expected the furnace in the basement to cause the conflagration, as soon as enough of the gasoline from the water cooler had dripped through the floor and formed a gas. But, to make doubly sure, he had sent his brother to throw some bit of burning stuff into the store. This was the man who had been seen slinking off to the motor car in the alley. The plotters were naturally committed to Auburn, where they still abide.

Because of the scientific recognition of the fact that fires may originate spontaneously in certain materials under special circumstances, and because of the wide publicity of the term spontaneous combustion, many efforts have been made among fire setters to simulate this natural phenomenon. Where such work is well done the chance of discovering the plot is small. False spontaneous combustion is, therefore, popular among the professors of arson.

One method of simulating a natural outbreak of fire is as follows: The fire setter takes an old barrel and packs it half full of oil waste, with a tiny spark burning in the middle. He then packs the barrel full and tight with old clothes, greasy papers and other materials of this sort. The little fire in the center of the greasy waste will smoulder for six hours or for sixty, according to the closeness of the packing. Finally, however, it will burst into wild flame and set off anything within reach.

Such spontaneous combustion barrels are often employed by dry goods and clothing merchants. The barrel is prepared with its spark and put into the rear of the store, where windows are kept open to carry off the odor of the smudge. The arsonist knows, of course, about how many hours must elapse before the flammation. Usually he waits for a week-end. He closes his shop at dusk on Saturday and goes about his pleasure. He has not, of course, forgotten to sprinkle a good bit of gasoline about near the smouldering barrel. Neither has he neglected to hang up coats, dresses, curtains, wrappers and all sorts of loose combustibles where the first flames will reach them.

Thirty-odd hours afterward, the smudge in the barrel breaks into brilliant flame. The fire spreads quickly to the gasoline-impregnated wood and the fire-hungry hangings. The store is gutted in a few minutes. Before the fire machines can arrive from any distance, the whole place is an oven and when the water from the hoses finally gains control of the fire the interior of the place has been so completely burned out that it is impossible to determine whether the best merchandise of the place had been removed in advance. In case the fire is found and got under hand before it has a chance to flare up well, the origin of the blaze must be found in a barrel of waste and only the expert will suspect that this spontaneous thing was a work of art.

But the individual fire setter is no longer so great a menace as once he was. The big and successful cases of commercial arson are managed in these times by organized gangs or arson rings, as they are called. Such cliques of fire specialists now operate in all parts of the country and a number of them, including all the members, have been sent to prison through the work of Mr. West and others.

The arson ring consists of the fire insurance agent, the insurance inspector, the crooked merchant, the expert fire-setter and the insurance adjuster. The merchant wants to have a fire. He resorts to the crooked agent who writes him a policy for far more than the value of the stock. The crooked inspector goes over the property, blinds his eyes to the fraud and approves the risk. In a little while the professional arsonists come along, remove as much as they think wise of the stock, saturate the place, set a pyrotechnic bomb of some sort and burn up the merchant's store. The business man is always away on a short vacation when such a blaze is produced. He comes back with great celerity, however, once his store is gutted, and puts in a howling complaint to the insurance agent. Now the interesting part of the comedy is played.

The crooked agent, who originally wrote the policies, sends the claim to his company with the recommendation that it be paid, as the loss is complete and the merchant a worthy man. The claim is passed to the adjuster, who proceeds to make an examination. His business is to find fraud if any exists, but in this case he makes it his business to overlook any that he may find. He reports to the company that the fire was *bona fide*, that the loss is complete and that payment should be made. The merchant gets his money promptly and divides with the other members of the ring. Simplicity and precision are the virtues of this plan of action. It is applied to many other types of insurance.

Sometimes the romantic and extravagant enters into the doings of the arson committer and lights this dark subject with a flare of infernal glory. The story I have to relate in this connection has been told by me before and by others, not too scrupulous about literary proprietorship.

**The interior of a store after a conflagration of suspicious origin**

A few years ago a boardwalk shoe dealer in Atlantic City vanished with a large stock of costly merchandise. Mr. West, sent to find the absconder and his wares, found among the few papers left behind by the vanisher, a bill for a dozen animal satchels. He could not imagine what a smart shoe shop might want with animal satchels until he discovered that they had been reshipped to the address of a man of the same name as that borne by the shoe merchant, in a small Pennsylvania town. The investigator hurried thither and found that the recipient of the animal satchels was in fact the father of the vanished shoe merchant. Let us call him Schwartz, since that was not his name. The elder Schwartz had been a merchant, had suffered several fires, all of them disastrous to the insurance companies and had finally retired. His son had then entered the mercantile field, with results already noted at Atlantic City.

Mr. West knew at once that the elder Schwartz was a rogue and one to be approached with caution. Accordingly, he began his campaign by indirection, asking questions here and there among Schwartz's townsmen and neighbors. Finally, he discovered that Schwartz was supposed to be an animal trainer. His past disputed this. The shipment of animal satchels confirmed it. Mystery! A little more watching and questioning decided the investigator on his course. He went away for a time, only to reappear in the garb and personation of a circus man. In this character he called on old Schwartz and was most coldly received. But he managed to force his way into the house. Only the feebleness of the old man rendered this physical trumping possible. In the kitchen Mr. West found a specially fitted gas jet over a small table. Under it snoozed two cats. One of them got up as he came in, arched her back lazily, lifted a paw and pulled the short chain of the gas tap, lighting the mantle from a small pilot. I suppose every reader will be familiar with such gas lighting apparatus.

West needed to know no more. He understood that old Schwartz was training cats for arson. A merchant who wanted a fire bought one of the cats and had a gas jet rigged in his shop, preferably in the basement. A little pilot, which burned day and night, set off an ordinary gas tip. The cat had her table just under this device and amused herself by playing with the chain, turning the flame up and down as old Schwartz had taught her. Then came the night of disaster. The merchant removed the tip from the gas jet and when pussy pulled the chain a great flame sprang up, igniting inflammables which had been arranged above it and

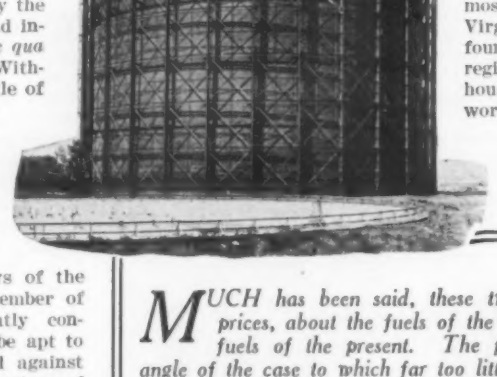
(*Continued on page 437*)

# The Fuel of the Future

## The Advantages of the Universal Burning of Gas, and the Obstacles in the Way of Its Attainment

*By Ismar Ginsberg*

WHEN the paleolithic Man discovered fire and learned that the earth about him abounded with matter that could be burned and in burning could furnish him with heat not only for bodily comfort in the cold of the winter but also for fashioning tools and weapons and for cooking his food, fuel first assumed its position of transcendent importance in human affairs. This position has gradually developed into one of even greater significance as society grew more complex and the arts and sciences of civilization were evolved, until today fuel is undoubtedly the most important single commodity employed by the human race in their home and industrial life. Fuel is the *sine qua non* of modern civilization. Without it, there could be but little of the comforts and luxuries of life; industrial enterprise would be practically nil—in fact, society, as it is constituted today, could scarcely exist. It is therefore not at all strange, when disruptive forces, such as strikes, make their appearance in the news of the day, that each and every member of society should become greatly concerned over the matter and be apt to view them as blows directed against the very foundation of the structure of modern life. A greater calamity cannot be imagined than the sudden shutting off of our supplies of fuel.



*MUCH has been said, these twenty years of rising fuel prices, about the fuels of the future and even about the fuels of the present. The present article develops an angle of the case to which far too little attention has been paid. Mr. Ginsberg reminds us that all fuel—coal, wood, oils or what you will—must be vaporized before or during combustion. He points out the incontrovertible fact that conversion of solid or liquid into a gas fuel can always be done more cheaply and more efficiently on a large scale in a special plant than on a piece-meal scale in the consumer's oil stove or coal furnace. Ergo, he tells us, the fuel of the future is unquestionably gas; and the gas tank which adorns this box ought to be the universal symbol for heat, light and power. To which we can think of only one rejoinder—Why not?—The Editor.*

A fuel is a substance in which there is concentrated great heating power. This power or energy is released when the fuel is brought to the proper temperature and burned. It is well known that all fuels do not burn with the same degree of readiness. Thus, while a piece of paper can be ignited by the heat of a burning match, and similarly the stream of gas issuing forth from the gas burner, nevertheless wood must first be heated upon a paper fire before it will itself catch fire and burn. On the other hand, coal is still more difficult to burn, and a wood fire must first be built under the coal so as to bring it to the burning temperature before it will ignite. It is also known that the different varieties of coal burn with different degrees of ease, soft coal burning more easily than hard coal. All burning is simply a rapid union of the carbon and the hydrogen and the various other elements, as they exist in the combustible, with the oxygen of the atmosphere. The products of ordinary combustion are water vapor and carbon dioxide, when the combustion is complete; with more or less carbon monoxide in place of some of the dioxide, when it is incomplete.

Coal is the product of the partial oxidation of vegetable matter under great pressure and in the absence of sufficient air to cause its complete destruction—a process extending over a period of a million years or more. According to the duration of this process, various kinds of coal were evolved. Thus the oldest form of coal is called anthracite, a product in which there is practically no volatile matter, almost all the combustible matter being in the form of a hard, compact mass, fixed carbon. Anthracite is sometimes called stone coal, because of its hardness and difficulty of ignition. It is the coal that gives very little or practically no smoke on burning. That is why it is used in domestic furnaces in cities for heating purposes and in making hot water.

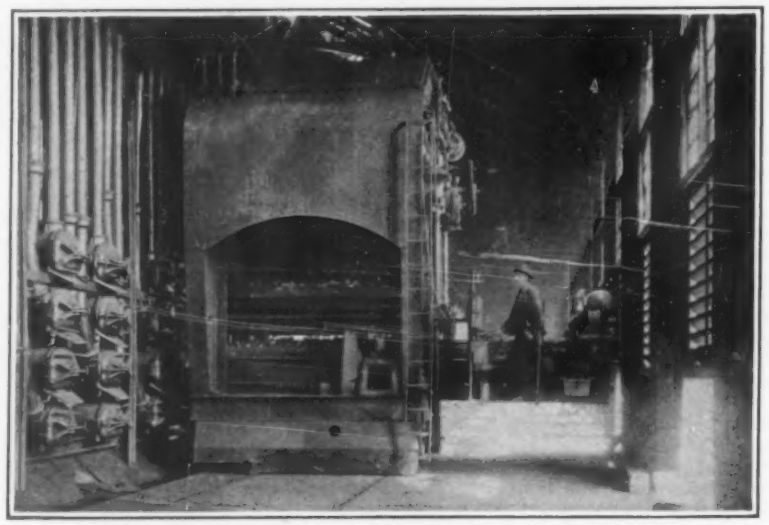
As the age of the coal decreases, it becomes softer, and richer in volatile constituents which produce smoke when it is burned. There are various intermediate grades. There is a semi-anthracite coal, found in comparatively large amounts in this country, and almost as useful for domestic use as anthracite. Then there are the semi-bituminous coals, the bituminous and the subbituminous coals. The bituminous class is the most important of all, for these are the coals of industry. The coal that is used for gas making (gas or coking coal) belongs to this class. A still younger coal is lignite, or brown coal. It is a substance that has not been subjected to so complete a decomposition as real coal, and hence it does not possess the heating value of the latter. Finally, there are the peat coals, which contain very high percentages of moisture, and which are not of any great technical or industrial importance. From a standpoint of usage they were probably the first coals used, as they are found so close to the surface that no extensive mining operations are required to render them available.

Coal is found everywhere. The United States contains vast deposits. Anthracite coal is mined mostly in Pennsylvania and West Virginia. Bituminous coals are found mostly in the Appalachian region, which is the greatest storehouse of high grade coals in the world. There are estimated to be three and a half billion tons of bituminous coals within 3000 feet of the surface in the entire country; and of this total, half a billion tons are found in that section. There are also large deposits of soft coal in the West. Lignite coal to the extent of one billion tons is found in North Dakota, Texas and Arkansas.

Wood is also a solid fuel, but it does not possess any great industrial importance. The only other solid industrial fuel of commercial significance, besides the coals and the artificially prepared products that are made from coal dust and tars, known as briquetted fuels, is coke. Coke is a product that is obtained when coal is distilled to produce gas, ammonia, tars and other products. Coke burns almost like hard coal. It is suitable for domestic use under the proper conditions and is also valuable as an industrial fuel, besides its application in a particular form, known as metallurgical coke, in the manufacture of steel. Coke is preferable to soft coal, for in burning soft coal it is very difficult to obtain complete combustion. This fact can be substantiated by observing the condition of the chimneys or stacks in any plant or building in which soft coal is being burned. The clouds of smoke emerging therefrom are a clear indication that a good percentage of the coal, as much as 10 per cent or more, is being discharged into the atmosphere in an unburned condition. Coke burns without smoke; the smoke and other products which are developed in the burning of soft coal in the furnace, and are thereby completely lost, are conserved and employed to useful purposes when the soft coal is first converted into coke in the by-product coke oven. In former days coke was made in beehive ovens and these valuable by-products were wasted. Today there is almost four times as much coke manufactured in the by-product oven as in the beehive oven, and great quantities of gas and other valuable by-products are recovered.

There was a time when by far the larger part of our fuel was solid, and anything else was more or less of a freak. Today liquid and gaseous fuels play a large rôle. The principal liquid fuel is gas oil. This is used in the manufacture of gas, to bring up the heating value of the gas, distilled from coal, so that it meets legal specifications. Crude petroleum is also used as a fuel. Naval vessels and the merchant marine ships use fuel oil in preference to soft coal, for it can be stored more conveniently and burned with a greater degree of ease and efficiency under the steam boiler. Fuel oil is also being used in firing domestic furnaces. In using fuel oil, it is necessary to employ storage tanks and pumping, atomizing and air-mixing apparatus. The price of gas oil and of crude oil as well depends on the demand for gasoline, which is ever increasing. One factor that has a material effect on the quantity of gas oil available for sale is the development that has been taking place in the production of gasoline by the cracking of the higher-boiling-point constituents of petroleum. The newest improvement along these lines is a process of cracking oil which will give a yield of gasoline as high as 80 per cent.

The gaseous fuels comprise not only the gas that is used in the modern kitchen, but also the various modifications of gas that are used in industrial processes, such as producer gas in steel manufacture, oil gas for small lighting installations, etc. We are concerned primarily with coal gas or water gas, which may be summarized under the one heading, city gas. Both are made from coal—the former by distillation of the coal in absence of air and the latter by blowing steam through a bed of incandescent coal or coke. Neither has the high calorific power that is demanded by law in most states, and hence gas oil must be cracked and the gaseous products mixed with them in order to make a mixed gas of 500 or 600 B.t.u. per cubic foot.



**Making gas: The charging machine in a horizontal retort house**

In considering gas as a fuel there are a number of fundamental principles which must be explained before a clear understanding of its value can be had. When any combustible burns, it is first transformed into gas and then the gaseous products are burned. This is an undeniable fact and can be proven to anyone's satisfaction by a simple experiment.

A piece of paper is rolled up tightly in the form of a tube. One end is closed by folding over the paper and a small hole is made in the tube near that end. The other end is open to the air and the paper is set fire to at that end. If the paper is held so that the smoke travels up the tube, as the latter issues forth from the opening at the closed end, it can be ignited and burned.

It stands to reason that if a fuel is first gasified before it is burned, the most efficient gasification will result in the greatest fuel economy. Each stove or furnace or any other apparatus that burns coal or coke is primarily a gas producer. The efficiency of such a producer must necessarily be low, and far below that of the gas-making apparatus used in the modern gas plant. In other words, from the standpoint of strict fuel economy, it is far more logical and more economical to make the gas first under perfectly controlled conditions and technical supervision of the highest order and then burn the gas as fuel, than to burn the coal, from which gas is or may be made, directly in the grate.

The carbonization or distillation of coal to give gas yields other products as well which are of the highest importance in industry. These products—benzol, sulfate of ammonia, oils and tars, coke or coky matter—are produced in even larger amounts when the process is carried out at low temperatures. The most recent development along these lines has been the carbonization of coal, arranged on shallow cast iron plates, which form part of a conveying system, and are led over a bath of molten lead in a suitable furnace. The process is known as the Caracristi process and is being installed in one of the Ford plants. It is claimed that the yield is from 7000 to 8000 cubic feet of 600 to 700 B.t.u. gas per ton of coal, five gallons of motor spirit, twenty pounds of sulfate of ammonia, 25 to 30 gallons of low temperature oils and about 70 per cent of a sort of coke possessing a good fuel value. The process is important because it tends to conserve the by-products, which are ever increasing in importance.

It is possible to demonstrate by making a careful examination and study of the conditions surrounding the burning of soft coal, coke or anthracite coal and gas, that of these fuels gas can be burned with the greatest thermal efficiency. Coke or anthracite coal may be burned with an efficiency of 60 to 65 per cent, soft coal with that of 55 to 60 per cent and gas with an over-all efficiency of 90 per cent.

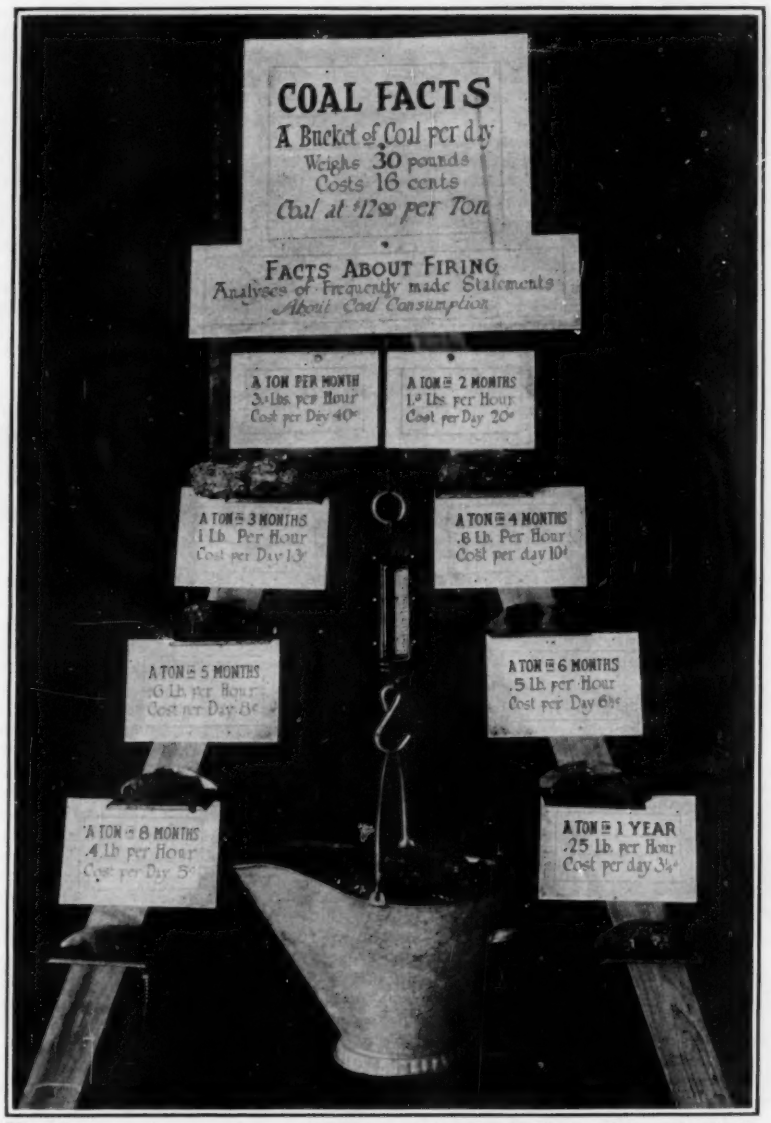
If gas can be burned so economically, why, then, is it not used in preference to the other fuels? There are other advantages in the use of gas besides greater thermal efficiency. Any householder who has used gas in heating his home can testify that it is much more convenient to fire with gas than with coal; there are no ashes to be removed, the control of the furnace is much simpler and far more effective, the house can be kept at more uniform temperature, and heat is not wasted by banking fires in warm spells during the heating season. It would appear that there should be no hesitancy at all on the part of the house owner or the factory manager to substitute gas for coal. But there is one—the higher price of the gas.

Gas today is being used for heating houses and as a fuel in many industrial plants. Its use is ever increasing for these purposes, and it finds no difficulty in entering the field, as a universal fuel, once the price disability is removed. In various industrial cities and towns throughout the country gas is being employed for many and in fact all purposes for which coal was used before. When the gas rate is adjusted to conform with local conditions—and it must be remembered that it is not equitable to compare the circumstances which caused a lowering in the gas rate in one city or state with those that entail a higher rate in another state or town, for each case is individual and necessitates different treatment—then there will remain no reason for not using gas in preference to other fuels, which compete more successfully.

The gas rate remains high in certain localities chiefly because legal regulations make it incumbent on the gas company to furnish gas with a high heat value. This means that the gas company must use high-priced raw materials in manufacturing gas, which bring up the price of the manufactured product. Gas can be made just as well from lower-priced coals, and gas oil need not be used to enrich the gas if a low heating value, say, 300 to 400 B.t.u. per cubic foot, instead of 550 or 600 B.t.u. per cubic foot, is permissible. It is a fact, substantiated by tests conducted by the Bureau of Standards in Washington and confirmed by experiments made before engineers of Public Service Commissions and gas experts, that there is very little difference in the efficiency of burning high- and low-heating-value gas. It is not necessary to mass a great concentration of heat units in a gas in order to obtain high combustion efficiency. Furthermore, it has been found by actual experience with the low-heating-value gas that a great saving in gas bills is effected by its use, for the consumer seems to be able to obtain the same good results with the same quantity of the low-heating-value gas as with the high. This seems paradoxical, but is proven by actual experiment under operating conditions to be correct.

Recently a momentous decision was made by the Colorado Public Service Commission in allowing each gas company within its jurisdiction to make gas of any quality that it finds to be best both economically and technically. The price is then adjusted according to the cost of manufacture and the cost of service. The consumer benefits directly, for he gets a cheaper gas, which enables him to use it for purposes which were heretofore exclusively the field of coal. The gas company benefits, for its business is enlarged and extended to new fields. The impetus toward the attainment of this condition must be given by the legal authorities in removing the disability that holds back the gas industry from performing its real function to society—a disability inherited from a day when the service rendered by gas was totally different from what it is now.

Gas can become the universal fuel. It possesses all the requisites of universality of usage. It represents the one logical solution of the fuel problem. When it replaces the use of coal and other fuels once for always in industry and in the home, we may say that a condition of maximum fuel economy will have been reached; the fuel situation will have been put on a sound economic, technical and political basis.




**Though the coal money is spent all at once, it is used all the time and a little at a time.. The above graphic statement may help the coal user to realize that his fire costs money every time he puts a shovel of coal upon it**

## The Laws of Vision and the Technique of Art

IN an interesting paper published under the auspices of the Rumford Fund in the February issue of the Proceedings of the American Academy, Messrs. A. Ames and C. A. Proctor and Miss Blanche Ames discuss the theory suggested by Birge Harrison, that a picture is most artistic when it reproduces our retinal impressions. The retinal picture is less distinct at the edges than at the center and is distorted in the "barrel" manner, while the retina itself is more sensitive to blue near the edge than at the center. When a photograph of a landscape or building taken with a camera having a lens with the same properties as the eye is compared with one taken with a corrected lens, that taken with the artificial eye produces the more artistic effect. On examining a number of pictures by distinguished artists, the authors have found evidence of the conscious or unconscious use by da Vinci, Rembrandt, Israels, Millet, Turner, Whistler, DeHoogh, and others, and by one living artist Orpen—of the technique suggested by these laws of vision. The authors urge that the retinal picture should be made the basis of the technique of art.

## The Deepest Mines

BRAZIL still contains the mine that goes the deepest below the surface of the earth, although the deepest below sea level and the nearest therefore to the center of the earth is in the United States.

The deepest hole in the earth is a gold mine in the state of Minas Geraes and is known as the Morro Velho or St. John del Rey mine. It is owned by the St. John del Rey Mining Company, an English corporation, which has been working it almost continuously since 1834.

The mine is now 6,726 feet below the surface at the top of the shaft through which it is entered. The next deepest mine is in the Kolar gold field of India, where one shaft descends to 6,140 feet. The Village Deep mine in South Africa goes to 6,100 feet. The deepest in the United States is Tamarack No. 5, a copper mine in the Lake Superior region, with a depth of 5,308 feet. The bottom of this shaft is 4,100 feet below the level of the sea, while that of the St. John del Rey is only 3,958 feet below sea level, since the mouth of the shaft is in a mountain country 2,768 feet above sea level. The Tamarack mine goes nearest to the center of the earth.

The temperature of the rock at the lowest level of the St. John del Rey mine is 117 degrees. The miners work in an air temperature of 98 degrees. The outside air has an average temperature of 68 degrees, but is cooled to 42 degrees before being forced to the lowest levels from which it is drawn to the surface by powerful fans. On its way to the lowest depths it gains heat from the rocks and from its own compression, because air at that great depth is considerably denser than air at sea level.

The mine is a dry one, there being no water at the lower levels, and because of the low relative humidity of the air which has been dried before being forced into the mine, the men are able to work under satisfactory conditions.

The St. John del Rey mine is not only the deepest mine in the world, but is operated by the oldest registered English mining company, organized in 1830 to work a mine at a place some distance from the present workings. This mine proved to be unprofitable, and in 1837 operations were transferred to the present site where they have since been carried on almost continuously.

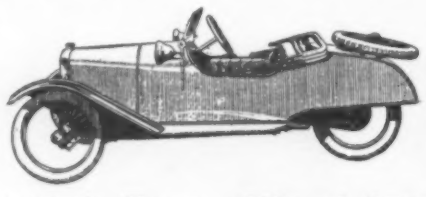
The deepest hole in the bedrock foundation of the crust of the earth has been recently reported to have been drilled in South Africa. It is not the deepest from the surface, but the point is that its 5,300 feet of depth is all in the pre-Cambrian strata, the underlying rocks which were laid down and finished some hundred million or so years ago. The other deep bores mentioned above are in rocks of more recent formation, or even, especially in the case of the Tamarack shaft, in superposed sedimentary material.—*Abstract from recent address by Dr. T. T. Reed, U. S. Bureau of Mines, before the N. Y. Section of the American Institute of Mining and Metallurgical Engineers.*

# Three Wheels Versus Four

## The Direction in Which the Development of the Economy Car is Pointed

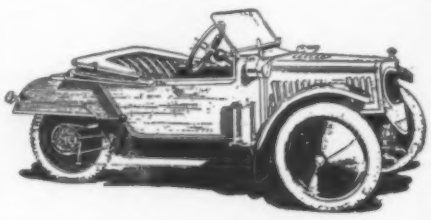
*By R. M. Sanders*

IN EVERY man's inner self from childhood days onward lies the desire to own a means to locomotion. Yesterday it was a horse and carriage, or maybe a saddle horse, and today an automotive vehicle of some description. Millions of automobiles have been produced, and still there are more people walking than riding. Many people are in a position to purchase automobiles, so far as the original cost is concerned, but the fundamental thing is: the small-income earner cannot afford to operate even the lowest-priced automobile on the market today. People therefore have become motorcycle and sidecar owners.



The motorcycle and sidecar combination is very economical to operate. We can easily realize this when it is possible to get from 40 to 50 miles per gallon of gasoline and 2000 to 2500 miles per gallon of lubricating oil. Then, again, there are but three tires against four on the automobile, without considering the fact that these tires carry less weight per tire than the automobile. The question of garage rent enters into the cost of those who reside in the city or town and do not own their own garages. The lowest rent per month for the smallest automobiles is approximately $15 to $20, against the motorcycle and sidecar combination of $4 to $5 per month. It is readily seen from the above figures that the cost of operation of the motorcycle combination is far less than operating a small automobile. The wear and tear (cost of replacement parts) is also in favor of the "combination," due to the fewer wearing parts on same.

To satisfy that "inner self desire" of owning an automotive vehicle, and yet to be able to operate one within their income without sacrificing other necessities, many people have purchased "combinations" in order to get out on the highways and byways of the country; though it must be said that many purchase "solo" machines (motorcycles) from a sporting viewpoint. Unfortunately, after acquiring a "combination" we find that ordinary every day clothing is unsuitable for all-day traveling on this type of vehicle. It is found that we must have special clothing or wear the oldest togs one may have. This applies to the guest who rides in the sidecar as well as the driver, but this is ordinarily considered trivial when you have the will and the desire to "see America first."



A boon to small-income earners would be in their ability to purchase a three-wheeler, such as is being manufactured abroad. A three-wheeler is a light car (if you care to call it that), light in weight particularly. It is called a three-wheeler abroad by virtue of the fact that it has but three wheels. The same number as a motorcycle and sidecar; but of much different design and arrangement.

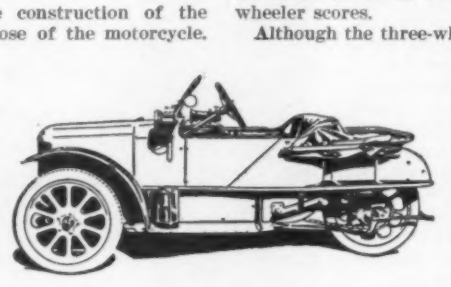
The outstanding advantage of the three-wheeler over its predecessor, the motorcycle-and-sidecar combination, is its comforts. The three-wheeler has a full seat upholstered the same as an automobile and wide enough to accommodate two people comfortably side by side. The body, as may be noted from the illustrations, is built along automobile lines. The springs of some of the three-wheelers abroad are of the half-cantilever type both front and rear. Naturally, the comfort of riding in a three-wheeler on a well sprung chassis and in a roomy body is incomparable to the "combination." The driver of a "combination," usually the owner, has none of the comforts that his guest enjoys riding in the well sprung and luxuriously fitted sidecar. In the three-wheeler both riders are equally comfortable.

Anyone who has experienced the displeasure of being suddenly overtaken by a rainstorm while driving on a motorcycle and sidecar will readily see the advantage the three-wheeler has over the combination. The sidecar is usually fitted with a windshield and top; but is it fair to the owner-rider to be seated out in the open, subject to ravages of the elements? It is possible, of course, to keep comparatively dry on a motorcycle if the rider dresses like a deep-sea diver, but who wants to do that? As it is, one has to wear old clothes or purchase special clothing. Whereas, when driving a three-wheeler, one can put on "Sunday-go-to-meeting" clothes and still enjoy the open country. Then, if bad weather is encountered, both riders have equal protection from the elements.

Sociability is a strong point in the favor of the three-wheeler; for it must be admitted by the most enthusiastic "combination" owner that it is exceedingly difficult to carry on a conversation with the fair rider of the sidecar. The fact that both the driver and the passenger are afforded equal protection from the elements and are seated side by side tends to make the longest journey a pleasure under the worst conditions in a three-wheeler.

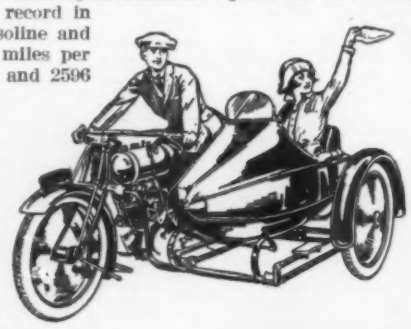
Riders of three-wheelers are never conspicuous through difference in dress when attending a gathering or at the theater, for they are able to ride to these various places without the necessity of changing their clothing upon arrival, whereas the "combination" rider has to.

The components used in the construction of the three-wheelers are similar to those of the motorcycle. The engines used are mostly V types, of the same cubic displacement and general design, the only variation being in the placing of the clutch at the engine instead of at the transmission. The cooling systems of the engines used abroad are equally divided between the water-cooled and air-cooled V engines. The clutch of the three-wheeler and the motorcycle are of the same size in area and capacity, for both engines are of the same displacement. The transmissions have approximately the same number of gears, though three-wheelers are equipped with three-speed gear boxes, two speeds forward and one reverse, whereas the motorcycle has forward speeds only.



The final drive is exactly the same as a motorcycle, as both drive via roller chain to a single rear wheel. The brakes are also similarly located and actuated, one contracting and one expanding, acting on the rear wheel. Some of the three-wheelers are fitted with front-wheel brakes as well.

Let us now make a comparison of the cost of operation between the three-wheeler and the motorcycle and sidecar. Abroad the initial investment in either machines is approximately the same. Inasmuch as we have the same engine size, same number of wheels, same load and weight to carry, it is logical that the cost of operating the three-wheeler is no more than the motorcycle combination. It has, in fact, been proven abroad that the cost of operating is less than the average motorcycle combination. The three-wheeler holds a record in England for economy both in gasoline and in oil—gas consumption of 67.1 miles per gallon (British Imperial gallon) and 2596 miles per gallon of oil. Tire wear also is less than with the "combination." So, with increased utility and less cost per mile, the three-wheeler is the most economical vehicle to operate.



When taking a general view of the three-wheeler from an engineering standpoint, we find that it consists merely of a rearrangement of the components to make use of the maximum power available to produce the greatest results.

In comparing the power application of both vehicles, let us suppose for example that we have a box to move. It is most likely that we would push at a point in the center of the rear of the box, to move it forward with the minimum of effort. It is quite evident that we would not push on one of the corners and expect it to move forward without also using some additional effort to keep it in a straight path.

The foregoing paragraph illustrates the improper application of power to a vehicle having three wheels, when the power wheel tracks directly behind and in the path of another wheel. Therefore, the arrangement of the wheels as used in the three-wheelers should be two wheels in front (used for steering), with power wheel placed directly behind the load to be carried and on the centerline drawn between the two front wheels. By so placing the driving wheel directly behind the load, instead of on the corner of the load, we have applied the maximum power available at the wheel which is in the most effective place. We have no lost power due to the tendency of a vehicle to move in a diagonal, as illustrated with the box. The "combination" has a tendency to turn around the sidecar wheel when the vehicle is moving in a straight line. This tendency of turning necessitates the holding of the front wheel of the motorcycle over in the opposite direction to overcome this tendency, thereby causing undue wear in the front tire of same. Naturally, this tire wears more than it would if it could travel in a straight line with the rear wheel of the motorcycle. Again the three-wheeler scores.

Although the three-wheeler weighs slightly more than the "combination," from an engineering standpoint it is exceedingly far in advance of the motorcycle and sidecar with a given useful load and available horsepower. Therefore, it is not only logical, but it has been proven, that the three-wheeler is more efficient than the "combination."

The three-wheeler was made on a small-scale production in 1910 and first exhibited at the Olympia (English auto-show) that year. The pioneer firm is still going strong and its product has increased in demand as the three-wheeler industry grew. There are today in Europe seven manufacturers of the three-wheeler, which is a proven vehicle abroad. There has been very little change in general design during the past ten years. The important automotive developments in reference to engines and other components have been adapted to the components of this vehicle as well as the other automotive vehicles. Abroad we find that most manufacturers of three-wheelers and motorcycles purchase their engines, transmissions and other components from parts manufacturers. The same conditions prevail as in our automobile field, which has proven so successful through the standardization work of the Society of Automotive Engineers. It was only natural that parts manufacturers should play an important part in three-wheeler progress.

The three-wheeler, in competition with the motorcycle combination and four-wheelers, has won more than 23 gold medals and 15 silver medals in meets. This includes speedways, hill climbs, road races, of both stock machines (driven by owner-drivers) and factory machines. They hold the economy record of 67.1 miles per gallon; also the speed record for one mile of 82.2 miles per hour. In Britain and on the Continent, many general competitions are open to them, and many more provide a special classification for them. The European automobile journals give them a place which, to one not familiar with their development, would seem altogether out of proportion to their importance; and correspondence columns indicate a very lively interest on the part of the readers in this type and its future. Distinctly it ranks as a small car, and not at all as a motorcycle, both in England and on the Continent.

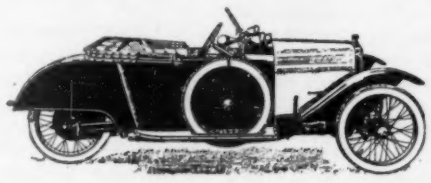
The three-wheeler has a definite place to fill. It will ultimately replace the motorcycle and side-car, which is a compromise and a very poor compromise at that. The public has never demanded any new machine before it was displayed and demonstrated. Once the three-wheeler is introduced in this country to the public, it will be possible for the small-income earner to satisfy

that "innermost" desire to own and operate an automotive vehicle. There are many people in this class to whom the "combination" appears dangerous and mysterious, due largely to the exposed units and necessity for special clothing. It may be predicted that the three-wheeler will recruit many more enthusiasts than the "combination," including a large percentage of the present "combination" owners.

The three-wheeler has one outstanding advantage which the motorcycle, with or without the side-car, can never meet. It can carry a battery and self-starter, and it has the reverse speed in its gear box. The absence of these makes the motorcycle fundamentally unsuited for general use by all members of the family; but the three-wheeler is just as easily started and just as easily maneuvered out of a tight spot by the weakest member as by the strongest.

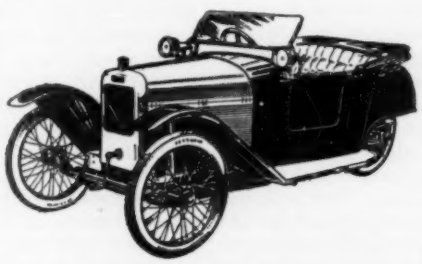
## Gelatine to Eat and Gelatine for Glue

IN our October issue, in his article on curious foreign foods, Mr. L. Lodian permitted his appreciation of a time-honored jest to run away with his discretion and to blind him to facts. Mr. Lodian, in speaking of Delft gelatine, refers to "the well-stewed viscera of old hoss" as the raw material from which this product is made. As anybody familiar with our pure-food laws would realize, such a concoction as he pictures would be quite unable to get past our customs as a food product. The fact is, as the leading importer of this substance points out to us, there are two grades of gelatine, one being for food and the other for glue. In Delft, as everywhere else, the two are kept quite apart, and one can eat Delft gelatine, or any other edible gelatine, without concern as to its origin. It is a matter of regret to the SCIENTIFIC AMERICAN that Mr. Lodian, in a vein of misdirected humor, should have made a statement implying otherwise, and that this statement should have slipped past the editorial blue-pencil.



## Trackless Trolley Details

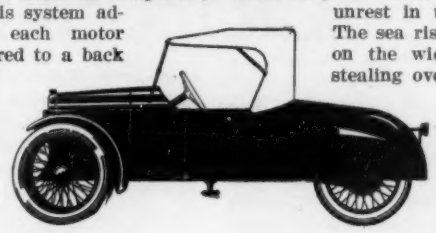
THE use of trolley buses in European countries has been covered in a very comprehensive way by Mr. H. L. Andrews, Railway and Traction Engineering Department, General Electric Company, who points out that European countries have for a great many years successfully operated trackless trolleys. In 1920 there were in England twenty companies with more than 100 miles of trackless trolley installations operating or authorized, while Italy had eight companies, comprising a total of 43.5 miles of route, and Germany had eight installations for passenger and freight traffic. France, Sweden and Austria have a number of installations in successful operation. There are in use in Europe three general systems—1st, Mercedes Stoll; 2nd, Filovia; 3rd, Max Schiemann—all of which differ in the method of drive and in the method of collecting current.



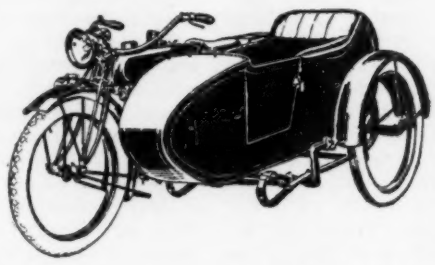
The Mercedes Stoll system is essentially a four-wheel drive, although two-wheel drive installations have been made. The driving motor is built into and is a part of the driving wheel. The control is arranged to give six speeds and three electric brake positions. When used with two-wheel drive the motors are connected in series for the first three points and in parallel for the last three positions. The arrangement for the four-wheel drive differs from the two-wheel drive only in having the two front-wheel or the two back-wheel motors connected in series. The collector used with the Mercedes Stoll system is of the overrunning or carriage type. The current collector at the trolley end is composed of a frame having two small grooved wheels with ball bearings on each side, one pair running on each wire. A cable with a double wire hangs down from the center of this frame or trolley and has a weighted pendulum which keeps the wheels well pressed down on the wires. This collector allows considerable movement from the trolley wire, and extreme movement is taken care of by means of a cable and reel on the car which allows 30 or 35 feet radius from the center of the trolley. When vehicles operating in opposite directions meet, the drivers exchange collectors and plugs, which are readily detachable and within easy reach.

For the most part these trackless trolleys weigh approximately 6048 pounds, less load, and have a seating capacity of 25. In some few installations larger cars weighing over 11,000 pounds complete are used. One installation is equipped to handle motor car and trailer cars; the motor cars having a seating capacity of 22 and the trailer cars of 20.

The Filovia system, which is in operation on more than 40 miles of route with eight different companies, has proved very successful. This system adheres to a two-motor drive, each motor mounted on the chassis and geared to a back shaft on which is mounted a sprocket wheel. Transmission of power to the rear wheels is by means of a chain drive. Each car is equipped with two 12-horsepower motors. The collectors used are similar to those described with the Mercedes Stoll system, except they are connected to the bus proper by means of a rigid pole.

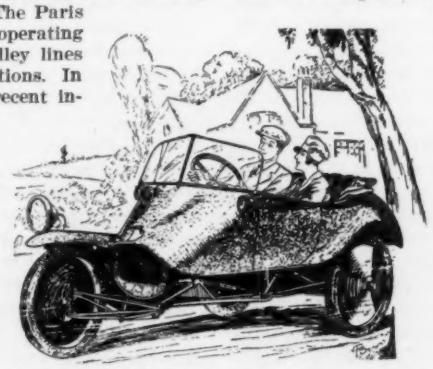


The Max Schiemann system has been employed extensively in Germany for both passenger and freight service. There are eight or more installations, three of which are strictly passenger service, four are entirely for freight and one handles both freight and passengers. This system uses a two-motor drive, each motor being mounted on the truck chassis and geared to a back shaft by means of bevel gears. Power is transmitted to the rear wheels by a chain drive. Three methods of collecting current are used with this system: 1st, two trolley poles under-running on the trolley wire; 2nd, one trolley pole with a double head carrying two trolley wheels; 3rd, overrunning carriage as described under the Mercedes Stoll system. This last method of collecting current has not produced good results, due to the damage resulting from the carriage's leaving the trolley wire.



English practice differs somewhat from any of the three systems previously described. Two motors are used, each being mounted on the truck chassis and connected to a jack shaft through worm gearing. The jack shaft carries a sprocket wheel and power is transmitted to the driving wheels by means of chain drive. This practice of using two motors and the method of operation have been changed somewhat in the more recent installations, particularly the one in Shanghai, China. On these buses two motors are used, mounted directly on the chassis, but the jack shaft and chain gearing are omitted, the motors being connected direct to the driving axle, using worm gearing, each motor driving one of the rear wheels.

English operators who have used the gasoline-propelled bus more extensively than we have until recently in this country, both independent of their railway systems and as feeders to their established lines, have stated that the gasoline-propelled bus, so far as it has been developed, cannot be operated at the same cost as the street car, and that they are not well adapted for handling peak loads, but they have found the gasoline bus well suited to operate as feeders or to connect up existing street railway routes. The Paris transportation system is now operating trolley buses in extension of trolley lines in rapidly growing suburban sections. In the United States and Canada recent installations have been made at Staten Island, New York City; Baltimore, Md.; Richmond, Va.; Minneapolis, Minn.; Los Angeles, Cal.; Toronto and Windsor, Ontario.



## World Revolutions

THE land surface of the globe has been, for the most part, many times covered by the sea in the course of geological time. The mountain ranges of the earth, as now known, have only recently attained their present elevation; other mountain ranges formerly existed which have now been all but obliterated by the remorseless effects of long-continued denudation.

It is important that we should study for a little what happens when a great mountain range is developed on the surface of the globe. There is a long period of preparation for the stately event; a period many millions of years in duration. First, there are signs of unrest in the solid land of the continents. The sea rises on the coasts and transgresses on the wide lands within, very gradually stealing over the lower levels. This process may not be steady and continuous. There may be periods of retreat followed by periods of advance, but always the land as a whole goes on sinking deeper and deeper into the sea. Many millions of square miles may be covered with the shallow seas—perhaps to a depth of two or more hundred fathoms—so that a considerable portion of the land area of the globe may become sea before the downward movement ceases. This transgression is a slow process; so slow and long-enduring that, while the submergence lasts, great depths of sediment accumulate in the transgressional seas.

Then at length there comes a resurrection. The land begins to emerge; but not the old land which went down. Where the great accumulations of sediment had been, mountain ranges arise. In short, what arises from the ocean grave is a crushed and wrinkled world, shattered by faults and over-thrusts and exhibiting every evidence of great horizontal compression. One attendant of these events is the outbreak of volcanoes and floods of lava welling out of fissures in the earth's crust. The latter generally appear along western coasts, or to the west of the new-born mountain ranges.

These events draw to a close when the land has attained its former elevation, more or less. There is then a new era of geological history, a long era of organic process, lasting many millions of years, during which minor oscillations of the crust and local deformation may occur. This is a period of active denudation. The last-born mountains are degraded by denudation, and their sediments collected into the great troughs or geosynclines, and the sublime but unreasoning sequence of events is repeated all over again.

Such has been in leisurely repetition the history of the earth. Certain world-revolutions are generally accepted—although geologists are not all agreed as to their number—as comprised in the period of 150 or 170 million years which the statistics of denudation and the record of thorium lead ascribe to the age of our era. Four or five world-revolutions appear to enter into that time interval. Thus 30 or more millions of years may, tentatively, be ascribed to the genesis and consummation of a world-revolution.—*From an address by Prof. J. Joly, F.R.S., before the Royal Dublin Society.*

## The Relation of Suicide to Climatic and Other Factors

IN A recent number of the *American Journal of Hygiene*, Dr. J. R. Miner presents the results of an extensive statistical analysis of the relation of suicide to climatic and racial factors, and to industrialism, occupation, urban conditions, age, and sex. It has long been recognized that the suicide rate is higher among the Nordic race than among Alpine or Mediterranean peoples. Mixed peoples usually have a higher rate than either of the pure races to which they belong. Foreigners in New York show a higher suicide rate than in the countries from which they came. The lowest rate is found in Ireland and the highest in Saxony, while the rate varies in different parts of France according to the racial composition of the population. Among Asiatic peoples, the Japanese and Chinese rates are high, while in India it is low (4.8 per 100,000). India appears to be the only country where female suicides exceed the male. The general trend of suicide rates has been upward during the last century, but the higher rates tend to become stabilized. Germany, France, Denmark and Sweden have high rates; Britain, Norway and the Netherlands low rates. In the United States the rates are lowest in the south and highest in the west.

# Our Point of View

## *Radio in the Frozen North*

RADIO, among other accomplishments, has robbed present-day arctic exploration of much of its former terrors. It has done away with the dreaded isolation that formerly went with such a venture. Men no longer pass out of touch with us once they leave behind them the northern outposts of civilization; for while they may be engulfed by the icy wastes of the arctic wilderness, the long arm of radio reaches out to give them courage and cheer.

Last March a dinner was in progress in honor of Dr. Donald B. MacMillan, the famous arctic explorer. Several naval officers were present. Dr. MacMillan, in the course of a little dinner talk, made the following significant statement:

"You naval men and yachtsmen have not the slightest idea of what the real hardship of the North is. It is not the lack of food, because I have proven that we can live for three years or indefinitely, on the food of the Eskimo. It is not the cold, because we have proven that if we eat and dress as the Eskimo does, we can stand as much cold as he. It is the solitude—everything going out and nothing coming in. No one to talk to besides our own party of seven men except a few unimaginative Eskimos, who grow very tiresome. Arctic explorers have in the past been forced to shoot their own men because of insanity brought on by the solitude."

At this point Dr. MacMillan was asked why he did not take an efficient radio apparatus with him, and his answer was: "In my 87-foot boat space is so valuable that we could not afford to give up the room necessary." Yet on his past expedition he took a small radio set requiring very little room, which radio set proved ineffective. So Dr. MacMillan was asked: "Well, doctor, fully 50 per cent of your space in the hold of your ship is given to food which you tell us you can do without. Why not give up some of that space to overcome the real hardship of the North?" His answer was to the effect that he had never looked at the question from that angle. Subsequently, and in preparation for his present expedition, the explorer gave up, not the space in his hold but two very valuable berths in the forward end of the fore-castle of his schooner "Bowdoin," to a powerful transmitter so that he might keep in touch with civilization.

And so our intrepid arctic explorer of today is keeping in touch with us from his frozen berth in the arctic wilderness. Dr. MacMillan's messages are coming back at frequent intervals, even though he is now frozen in for the winter at Refuge Harbor on the northwest coast of Greenland, within 11 degrees of the North Pole. When it was first announced that he was to take both radio receiving and sending apparatus into the arctic, many engineers and scientists said that he would never be able to penetrate the curtain of the auroral band with radio messages. This has been disproved. When Dr. MacMillan first arrived inside the auroral band it was difficult to get messages back because of the fact that he was on 24 hours daylight; but now that he has a period of darkness the messages are coming back with great regularity. The American Radio Relay League, composed of the amateurs of the United States and Canada, sent Mr. Donald Mix, an expert radio operator, with the MacMillan expedition; and all the amateurs are standing by nightly in their endeavors to hear MacMillan.

So much for the "going out" part of radio. But how about the "coming in" part? That is the feature which combats the worst terror of arctic exploration—solitude.

Simple enough. Our broadcasting stations take care of the arctic explorers. Each Wednesday evening at midnight, Central Standard Time, we talk to Dr. MacMillan from the Zenith-Edgewater Beach Hotel broadcasting station, WJAZ, and give him not only a résumé of the week's news, but also the messages from his friends and relatives and from the friends and relatives of his crew of seven men. And this takes place in the spoken word, please note, and not the awkward and slow dot-dash code of the radio telegraph. Aside from this personal service, MacMillan and his men are enjoying radio programs to the utmost—music, talks, sporting events, and so on. Where is the solitude of the far North?

## *The Laborer and His Hire*

IN THE series which has now come to carry the title "Psychic Adventures," the articles describing Mr. Bird's experiences with Messrs. Sloan, Powell and Hope placed emphasis upon the claim that these mediums do not profit financially from their mediumship. In advancing this claim, we were merely repeating what had been told Mr. Bird, in London, by persons who were in a position to know the facts.

Since the appearance of the articles in question, we have heard from Mrs. McKenzie, of the British College of Psychic Science. It is through Mrs. McKenzie that financial arrangements with these and other mediums are made; and when she speaks, we may substitute, for the belief that she "ought to know" what she is talking about, the positive assurance that she does know. The facts, according to Mrs. McKenzie, are not quite so simple as they had been made to appear by those eager to put the mediums in the most favorable light possible.

Mr. Sloan, so long as he remained in Glasgow, literally received not a penny for his mediumship. When he came to London, however, employment was found for him at common labor, paying him ninety shillings per week—well above the prevailing scale for such work; and in addition, from College funds, one pound per week was laid aside for him against emergency.

Mr. Powell gives many sittings to his friends, either with no charge or with the mere remission of his expenses. But when he comes to London, he leaves his business for a week at a time, and it is at once proper and necessary that he receive compensation for this. Mrs. McKenzie does not speak in pounds and shillings here, but she characterizes the fee which Mr. Powell receives for his monthly appearance at the College as "handsome."

Mr. Hope *has* calculated what he could earn at the carpenter's bench in the time occupied by a photographic seance, and *has* fixed a charge accordingly. But this charge applies only to those who go to him at Crewe; and even then, many sitters give him a ten shilling note or even a guinea and insist upon having no change. When he comes to London, the same situation exists, to less degree, as with Powell; and he gets enough to justify the trip.

The spiritualists who in argument slide over and even falsify these facts, do so with no realization that they are misrepresenting. They are firmly convinced of the good faith of their mediums, and are impressed with the large spiritual satisfaction which the seance gives for a comparatively small return. Feeling so strongly that the medium gives more than he gets, they rush to his defense when the implication is made that he works for money. And they defend him not wisely, but too well.

Sloan while in London derived, Powell and Hope habitually derive, no small part of their livelihood from their mediumship. Our spiritualistic friends would do far better to face this fact than to seek to explain it away. For the medium devotes a very considerable part of his time to his mediumship; and in a day when money alone makes the mare go, why should he not receive a fair remuneration for this time?

The condemnation of a medium on the mere ground that he accepts fees, the implication that he should serve without pay, has always impressed us as the height of hypocrisy. Of course to the blatant fraud who swindles widows out of their insurance money through "messages" from their deceased husbands these remarks do not apply. We speak only of the medium who gives ordinary seances at a fixed or sliding fee and gets no oblique return from his mediumship.

For after all, even a medium must live. Nobody has ever suggested that the doctor ought to have a job, on the side, as carpenter or hack driver, earning his living from this and giving such time as he can spare from it to the gratuitous healing of disease. Nobody has ever argued that the priest or the minister ought to take in washing to support himself, marrying and burying people and healing spiritual sores gratis, between turns at the wringer. The medium, to the people he serves, gives just as real a service as does the doctor or the parson to his constituents. Why ask him to give it for nothing?

## *Unite Atlantic and Pacific Fleets in One*

THE American Legion, in Annual Convention in 1922, adopted unanimously the following resolution: "We believe that all combatant first-line vessels should be concentrated in one fleet for purposes of better training and more economical administration; further, that this fleet should be based where it can be maintained and administered at the least cost to our government."

Our late President assured us that the Federal Government will have to practice economy for many years to come. This is true of every department of the government; and since the Navy spends annually more than 300 millions of our revenue, it should practice rigid economy and stop only at the point where further reduction of expense would interfere with efficiency.

Now, one direction in which a large reduction in expenditure could be secured, is to reunite our present disunited, first-line battle fleet. For nearly twenty years before the World War, our first-line battleships were concentrated in a single fleet, based in the Atlantic; but in 1920, apparently for political reasons, Secretary Daniels split the fleet in half, placing part in the Pacific and part in the Atlantic. The moving of the more powerful half of our battle fleet into the Pacific, together with Mr. Daniels' program for building sixteen battleships, produced considerable anxiety in Japan and a counter-building program was started in that country. Happily, we have agreed to a 5-3 ratio as regards Japan, with no development of naval bases west of Hawaii, and have signed the Four-Power Treaty for the settlement of any future difficulties in the Pacific. As regards that ocean, our Secretary of State has assured us that there is now not a cloud in the horizon.

There was never any sound military reason for splitting up our battle fleet; naval opinion indeed was all against it. Our ablest strategist, Admiral Mahan, long ago warned the American people against dividing our fleet between the Pacific and Atlantic. He attributed the overwhelming of the Russian fleet by the Japanese largely to the fact that it was divided and each fleet defeated in detail. "It is precisely the same," he wrote "in application as well as in principle, with the Atlantic and Pacific coasts of the United States. . . . Concentration protects both coasts, division exposes both."

Concentration makes for efficiency. The larger the fleet, the better training it affords both for officers and men; since the maneuvers are more realistic and simulate more exactly those that would be required in battle. The battle fleet is a team, and team work is essential. How futile it would be if the Harvard football team should train its line in Cambridge and its back field in Pasadena and then bring them together on the day of an important game!

Concentration of the fleet, furthermore, would result in marked economy. Our railroads and corporations consolidate to eliminate overhead and reduce expense; our battle fleet must do the same to reach the same end. With the fleets united, fewer admirals with their numerous staffs would be required. There are hospital ships, supply ships, tugs, etc., serving the battle fleet in the Pacific, and identical vessels serving the battle fleet in the Atlantic. Consolidation will eliminate many of these auxiliaries, and make a marked reduc-

# Our Point of View

tion in the number of officers and men then required.

But where shall the united single fleet be based? Now that the so-called Japanese menace has vanished, there is every reason why the fleet should be based in the Atlantic. Let us consider some of these reasons. In the first place, there are eighteen states bordering the Atlantic, while only three border the Pacific, and those Atlantic states provided in 1920 for the upkeep of the Navy eleven times as much revenue as those on the Pacific seaboard. More than three-quarters of all our states and 92 per cent of the population of the country have a natural outlet on the Atlantic, and they provide 94 per cent of the money spent by the Navy. Basing half of our fleet in the Pacific, so far away from the center of population, brings added expense and waste of time in transporting officers and their wives and families out to the Pacific and then back again at the end of their tours of duty. Several naval transports are now engaged in this work.

Since the industrial centers of the United States are in the east, it follows that most of the ammunition, stores, equipment, etc., are manufactured in the east, and half of these, if the fleet is divided, must make the long and costly transit by sea to the Pacific coast, thereby adding greatly to the expense.

Last, but by no means least important consideration in favor of a single fleet, is the fact that the Atlantic seaboard has had many millions spent on it to develop Navy yards and bases for handling our battle fleet. Today these are all operating at reduced efficiency, with high overhead expense, because most of the work for which they were designed is now being diverted to the West Coast, where plans are on foot to spend millions more of the public's money in developing bases, which can just as well wait until there is more money in the Treasury for such purposes. This is no time to spend millions in building up new Navy yards, when there are ample facilities for handling the whole fleet in the Atlantic.

## *Hudson River Bridge and the War Department*

THE PROTECTION of our rivers and harbors against private encroachment is one of the important duties of the War Department. Before any bridge can be thrown across a navigable river or any other kind of waterway, it must receive the sanction of the Army Engineers. It was because of these conditions that a public meeting was held recently in the Army Building, New York, for the purpose of hearing the arguments for and against the great bridge which is proposed across the Hudson River, at or near Fifty-ninth Street. It augurs well for the future of this great enterprise that the meeting was crowded, and that some forty letters in approval of the bridge had been received as against three or four against it.

The principal objection, as voiced at the meeting, came from an unexpected quarter and certainly in an unusual form. We refer to the claim of one of the leading trans-Atlantic steamship companies, that, although the bridge was located as far up the river as Fifty-ninth Street, it was yet so far down the river that it might prove to be an obstruction to the maneuvering of the larger ships when they are entering or leaving their piers. It seems that the masts of some of these vessels extend 200 feet into the air, or 50 feet higher than the bottom of the proposed bridge.

To those of us who are familiar with the Hudson River, the location of the piers of the great steamship companies, and the manner in which the biggest ships are swung across the stream and coaxed into their berths, it will seem rather absurd to claim that a bridge which is one-third of a mile distant from the piers could interfere with the docking maneuvers. A capable captain, in making for a pier, does not over-shoot the mark by twice the length of his own ship, and if he should do so he would prove himself to be incompetent and a candidate for reprimand or dismissal. The steamship companies have been generously treated by the city, which now asks that, in return, they shall do nothing to obstruct a great project which aims at the solution of one of the most pressing transportation problems of the city and the Metropolitan District.

## *The Industrial Fellowship System*

WHEN future historians tell the story of the industrial development of the Twentieth Century, if they have a just sense of proportion they will lay due emphasis upon the increasing cooperation between industry and science which has been such an outstanding fact of the past two decades. Our readers will remember the illuminating articles contributed by the late Dr. Robert Kennedy Duncan upon the Industrial Fellowship System of which he was the originator. This was placed in experimental operation primarily at the University of Kansas in 1907, and it was inaugurated at the University of Pittsburgh in 1911. Two years later, the present Secretary of the Treasury and his brother established the Mellon Institute of Industrial Research on a permanent basis, and their continued financial support has made it possible to bring the system up to its present strong position.

What is the Industrial Fellowship System? Its aim is to promote industrial success through scientific research; that is to say, to find new materials and new processes for industrial development, and to advance manufacturing through the application of scientific methods to industry. Its methods of operation are as follows: an individual industrialist, a company, or an association of manufacturers, having a suitable problem, or several of them, requiring investigation, may become the donor of an Industrial Fellowship, provided that the problems are of sufficient scope to warrant the services of at least one man for a period of at least one year, and provided, also, that there is no other investigation in process in the Institute on the topic suggested by the prospective donor. Thanks to the generosity of Secretary Mellon, the Institution is entirely independent and derives no financial profit from the investigations which it undertakes. Therefore, it is in no sense of a commercial nature. Furthermore, the executive staff of the Fellowship devotes itself to the interests of the Institute (which, by the way, is a part of the University of Pittsburgh), without outside remuneration.

It should be explained here that the donor provides a foundation sum sufficient to cover the annual cost of the Fellowship including operative charges, purchases of all necessary apparatus, and pays the salary of the research man or men selected to work on the particular problem. The Institution on its part selects the Industrial Fellow for the particular investigation which is entrusted to him and to this he devotes his entire time. Also, it furnishes laboratory, library and consulative facilities; but all results obtained by the Industrial Fellowship belong exclusively to the donor.

Although the results of the investigation are confidential, many of the valuable data obtained are, by the courtesy of the donor, available for publicity and, as our readers are aware, no small part of this material has appeared from time to time in the SCIENTIFIC AMERICAN.

## *High-Speed Electric Traction*

IN A recent issue, under the heading "How fast shall we travel," it was shown that from fifty to sixty miles an hour is the maximum schedule speed on the best appointed railroads here and in Europe. The limiting factor is the length and weight of the trains which are necessary to meet the ever increasing demands of passenger travel. It will be possible to make a considerable increase in the speed of express trains only by reducing their size and passenger capacity. To haul a steam train of twelve to fourteen heavy cars at an average speed of from sixty to seventy miles an hour would call for a weight of engine beyond the capacity of our existing tracks, bridges and tunnel clearances.

If the speed of future railroad travel is to be materially increased, it can be done only by the adoption of electric traction and the use of multiple-unit trains. The multiple-unit method permits of a great increase in the total horsepower without exceeding the loading limit for rails, bridges and structures.

The fastest speed ever made on a railroad was achieved some 20 years ago in Germany, on a military railroad between Berlin and Zossen, where some costly experiments were carried on to ascertain how high a speed could be obtained on steam railroads under electric traction, and at what expenditure of power. The experimental runs were progressive. The speed soon passed the 100 mile per hour mark, and then rose, successively, to 110, 120 and finally to 130 miles per hour. The limiting conditions were found to be not in the car but in the track, which proved to be unable to stand up under the severe stresses imposed upon it; and this in spite of the fact that it was specially prepared for these trials.

We are thus brought to the conclusion that schedule speeds of 100 miles an hour can be attained only where the topography is favorable to fairly level and straight lines. Even under these conditions it would be necessary to design a special roadbed and track of costly construction, involving many tunnels, long and costly embankments, the elevation or depression of the tracks through all towns and cities, and the complete elimination of grade crossings. Also, the road would have to be equipped with some form of automatic train control, simple, rugged, and absolutely reliable.

But when, if ever, such a road were built, its cost both for construction and maintenance would be so great that its use would be restricted to those whose purse was deep or who, by reason of emergency, were willing to pay a high price for an extra forty to fifty miles per hour of speed.

## *Thoughts on the Threatened Timber Famine*

WHAT WE had to say in our September issue on the possibility of a timber famine has brought to this office a thoughtful letter from Mr. James D. I. Wood, in which he suggests that in considering the world's diminishing supplies, a distinction should be made between coniferous woods and hardwoods, and directs attention to the vast area of hardwoods in the tropics which has yet hardly been touched. When the scarcity of coniferous woods becomes so much a fact as to raise the prices of lumber, it will be more profitable, he believes, to take out many of these tropical hardwoods than to attempt to raise the comparatively slow-growing hardwoods in our more northerly climate.

Then the question is asked, whether it would not be wise to consider conservation under the two separate heads of protecting our watersheds and of carrying on forestry as a paying proposition. The Weeks law and other similar statues afford protection to watersheds and natural parks; but, according to our correspondent, "it yet remains to be demonstrated what policy will best prevent a timber famine," and the work of the Forestry Products Laboratory at Madison, much of which has been described in the SCIENTIFIC AMERICAN, is referred to as giving the country much valuable assistance in forest conservation. The greatest enemy of our forests, the one that does far more damage than the axe of the lumber man, is the annual forest fires. The government is doing much to combat the fire menace. Congress should furnish it with funds to do much more.

In his plea for putting the question of timber preservation on a strict business basis, our correspondent asks whether it would not be false economy to plant all waste lands simply because they are waste. It should be done only when it is certain that such lands would yield a profit in return; and the suggestion is made, that because of the more rapid growth of timber in the southern than in the northern central states, it might be more profitable to do our planting in the southern states, even though the freight rates remain high.

# Another Mediumistic Failure

## Our Committee Sees "Independent Writing" Produced by Substitution of Cards

*By J. Malcolm Bird, Secretary to the Committee of Judges*

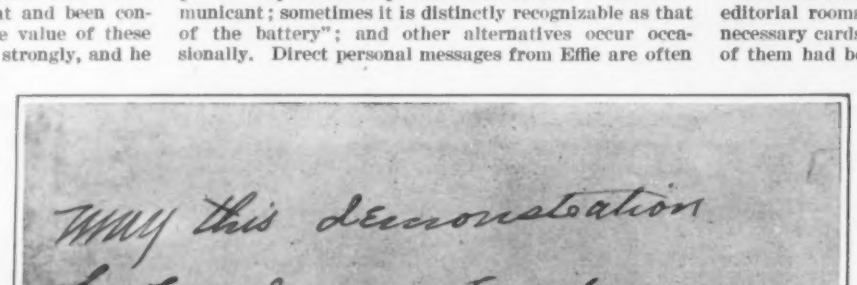
WHILE Sir Arthur Conan Doyle was touring this country last Summer, he met a medium residing in one of our mid-western cities. He had no opportunity for a sitting with her, but she showed him a large quantity of affidavits which had been given her by persons who had sat and been convinced that she was genuine. The face value of these documents was such as to impress him strongly, and he brought her mediumship to our attention. We communicated with her, and she agreed to come to New York and sit for our Committee.

The ornamental material on these pages will have caught the reader's eye and informed him that he is to be told the story of an attempt to produce psychic phenomena through fraud. But, as we have often emphasized, we are investigating, not mediums, but phenomena. The identity of an unsuccessful medium—even of a fraudulent one—is therefore no pertinent part of our story; and we shall withhold this lady's name, as we withheld that of our medium of last May. For present purposes she shall be Mrs. Y.

Partly through correspondence and partly through personal interview after the medium's arrival in New York, we learned the general character and the procedure of her manifestations. Their classification would be independent writing. The messages are produced upon pieces of card or paper, through the apparent instrumentality of flowers, leaves, etc.

The flowers used must be of colors recognized by the medium as "soft." From them she breaks off a quantity of petals and leaves. For the reception of the mysterious writings she habitually employs index cards of fairly heavy stock, about five by three inches. At a single attack she handles anywhere from a dozen to a hundred or more of these.

The first step is to place the fragments of the flowers among the cards. No attempt is made to get petals or leaves between every two cards; they are merely placed in considerable quantity here and there through the pile. When this has been done, the cards, of course, are rather wabbly, and cannot be stacked accurately. Mrs. Y takes the pile loosely in her right hand; and the usual procedure is to hold it over the head of some member of the group whom she recognizes as her "opposite." She characterizes herself as magnetic, and requires that the "battery," as she calls the collaborator, shall be "electric." She gravitates toward males in preference to females and toward dark complexions rather than light. After holding the cards upon the "battery's" head for an indeterminate period, it is found, to quote her own explanation, that "the coloring matter of the flowers has been precipitated by the psychic operators to form written messages upon the cards." These messages are not, as one might infer from their mode of production, done in wide, sloppy lines. The effect is entirely that of actual penmanship in colored inks. The medium does not profess to understand the details of the process; all she claims to know is the procedure, and the fact that the messages appear.




**This "spirit message," from a man whom at the moment the sitters supposed to be living, is in a brilliant gold pigment, which under microscopic examination shows actual metallic crystals**

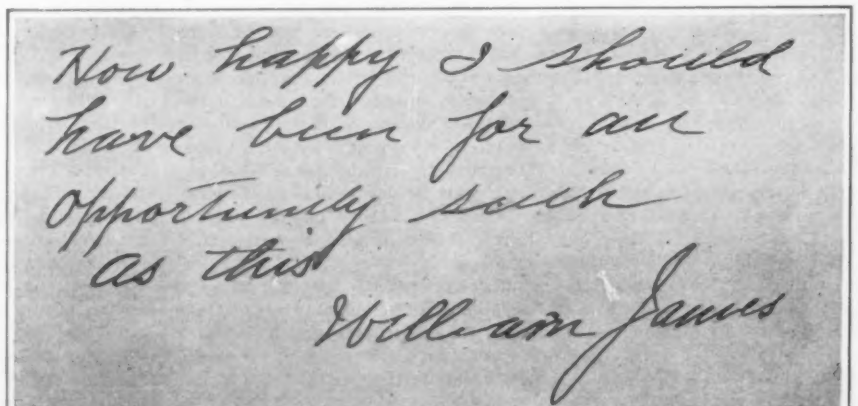
In any attempt at independent writing the identity of the penmanship is always of great interest. Mrs. Y, in response to questions, explained that she has a spirit guide named Effie. Effie, if I may borrow from one of the local reporters, is a sort of stenographer of the beyond. She has her own characteristic penmanship, and the messages are often in it. Sometimes, however, the signature is different, and may or may not be obtained, presumably always in suitable chirography.

The Editors and Committeemen in advance, and several sitters during the seances, asked the medium where, in the pile of cards, the writings usually came. On this point she contradicted herself repeatedly. Now she would tell us that the writings appeared only upon cards adjoining flowers; now that they would come on the three or four bottom or top cards; and several times when the cards were examined for possible writings she insisted that the searcher look at every card. These contradictions were repeated so flagrantly from day to day that the attention of the most sympathetic sitters was drawn to them.

If the phenomenon just described occurred genuinely, it would, of course, be one of the most extraordinary of all psychic manifestations. Indeed, it would probably be quite unique; none of our investigators had ever before encountered claims remotely approaching Mrs. Y's. I shall, therefore, make it quite clear, before taking up any of the collateral aspects of the sittings, just how we know that the writings produced in our presence were not genuine.

The first sitting was held in the SCIENTIFIC AMERICAN editorial rooms on October 9th. We had procured the necessary cards from a local stationer. A package of 49 of them had been counted out and was turned over to the medium at the beginning of the seance. She tried, with one "battery" or another, for about an hour, and finally confessed failure, expressing confidence of better results next time. Now and again she tore up one or more cards, as soiled. Mr. Lehmann at one stage made a mild attempt to take these fragments from her and throw them in the waste basket. It was not at all a determined effort, nor one that Mrs. Y would have had to exert herself to defeat. She did defeat it, retaining the fragments to the end of the sitting, when she handed them to another sitter for destruction.

After the medium had gone, the room was thoroughly searched and all fragments of the cards recovered. None of them had been torn into small pieces, and it was possible to patch them all together. When this had been done, we had only 44 cards. Our impressions during the seance had been that if, under the given conditions, the writing as described to us was to be produced *by fraud*, the fraud would necessarily involve the substitution of previously prepared cards. With *our* flowers, *our* cards, and *our* conditions, we were most reluctant to believe that the writing could be actually manufactured, *fraudulently*, in our presence. The disappearance of five cards seemed to confirm this view. But we could have no idea whether our own cards were to be substituted back, or whether they were to be used as samples from which other cards would be obtained for this purpose. The former procedure would be the safer, but would be open to the objection that the number of writings which could be produced under it would be limited.




**This distinguished communicant, on the other hand, writes in a reddish fluid ink which, under extremely high magnification, shows no grain or other structure. Stray crystals of gold here and there indicate that this card was written with the same brush as the one pictured above**

For the second sitting, held in our office on Thursday, the 11th, we had to meet both these possibilities. The medium, on turning over to me the cards that remained after Tuesday's session, had requested that these identical cards be employed on Thursday, since "they would probably have a lot of magnetism left in them" from her handling. After I had rejected a few badly stained ones, there remained 33 cards. These were marked by tiny pin pricks in one corner of each card, and a[illegible] the cards placed with their marked sides down. The lady, however, whether by accident or because she is a good psychologist, turned the package over in placing it upon her little work table. She sat down at this table and, under pretense of looking for dirty cards, examined the pack. The first four or five cards she scrutinized with an extreme of care quite incompatible with this explanation; then, looking for all the world like a person who had found what she sought, she went through the rest more rapidly, rejecting one or two which were no dirtier than the others. I had no doubt that she had found the pin marks, and the other investigators agreed with me.

While thus examining the cards, Mrs. Y asked me whether the cards *used on Tuesday* had been counted. It was with difficulty that I restrained a smile as I told her yes. She expressed gratification at our thoroughness, and I was highly gratified at hers. During this sitting she again tore up cards; but this time she

tore them so minutely that, within a reasonable time, I couldn't patch them together into whole cards. So I weighed them, and found that the fragments were exactly equivalent to eight cards. Since we had got back 25 whole cards, the account balanced for this seance. I could not avoid the conclusion that the medium had hoped to make this accounting impossible, and thus to destroy our confidence in any accounting which we might think we had made for the previous sitting.

We had anticipated, and indeed had rather hoped, that the pin marks might be found. They had served their purpose; for future sittings we had adopted a different plan; and we were very glad to have the medium's attention turned toward such things as pin pricks. Packages of 49 cards had been made up, and sent to the trimmer. For the third sitting, held in this office on Monday, the 15th, we had three such packages. Off the cards of one, 1/32 inch had been trimmed; off those of the second, 2/32; off those of the third, 3/32. The trimming was at the end, leaving the height of the cards unaltered. This expedient had been decided upon after the first sitting, during which we had observed that the manner in which the medium held the cards, and the presence of flowers, etc., between them, would make it difficult or impossible for her to detect the discrepancy in length, either by eye or touch, unless she explicitly looked for it.

At the third sitting I handed her one of these packages, the one of intermediate length. Two cards were missing at the end of the seance, after which I destroyed sixteen on account of stains. Like the first and second sittings, this one was wholly blank in its results, and we were beginning to wonder whether we should have to send Mrs. Y home without having seen her writings. Toward the end of the sitting, while the possible reasons for the repeated failures were being discussed, it was suggested that we go to the open air for our next meeting. Mrs. Ned Wayburn, of Bayside, L. I., was present as a guest of the staff; and she offered the use of her lawn. The sitting at which the writings were finally obtained was therefore held in the country on Tuesday, the 16th.

Mrs. Wayburn and I supplied the necessary transportation. I took with me all three sets of trimmed cards—31 in one, 49 in each of the others. The two full packages went into use; the short deck remained in my pocket. Under circumstances detailed below, we obtained writing on five cards. For various reasons, it was difficult to make certain that all the cards had been gathered up; with this reservation, the count showed that seven cards were missing. If none was overlooked, this would mean that twelve were withdrawn and five substituted.

Owing to the presence of the *Times* reporter, and to the necessity that two of the company get back to the city quickly, all examination of the cards was deferred; for, once this was started, we could not tell, in advance, how lengthy or elaborate a process it might be. We therefore made, in the Committee's name, the very obvious and non-committal statement that the medium had made out "a *prima facie* case." Perusal of the story as it appeared in various newspapers would indicate that the editorial profession is in sad need of renewing its acquaintance with the dictionary, so far at least as these words are concerned.

All the cards from the sitting were put in one package, and deposited in my pocket. In my car I took the reporter, Mr. Lescarboura and Drs. Carrington and Prince. Mr. Jones we dropped at Fifth Avenue, Dr. Carrington at Columbus Circle, Mr. Lescarboura at 125th Street; Dr. Prince I drove all the way home to Montclair. Dropping him there at 9 o'clock, I reached my own home in Scotch Plains at 9:45, and within three-quarters of an hour I was able to call Mr. Lescarboura at Croton and assure him that substitution had been practiced.

The most damning item was that of length. The five cards bearing writing were all of the same length as those used at our first sitting, and therefore 1/32 and 3/32 inch longer than those which we put in circulation at Bayside. Their number, however, was a coincidence; they were *not* our missing cards from the first sitting, substituted back, as the following facts show.

In color they deviate from our cards to a surprising degree. To a score of persons I have handed a pack of six cards—the five written ones, plus one of ours—so arranged as to expose a little of the blank end of each card. In no case has there been a failure to distinguish our card instantly. Our cards are a brilliant white, the medium's decidedly grayish.

The micrometer shows further variation. In ten-thousandths of an inch, the written cards gage, one 120½, two 121 and two 121½. Gaging about a hundred of our cards, the thinnest I find is comfortably over 122; the average is a shade over 123. Gaging in groups of five confirms that the written cards average a full two ten thousandths thinner than ours.

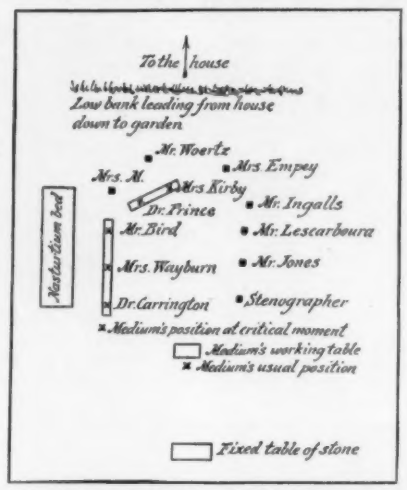
An even more startling way of putting this will be evident if we realize that all of the written cards are thinner than *any* of ours. Approximately 100 cards were at the medium's disposal for this sitting. Selecting five of these at random, for spirit writing or any other purpose, what is the chance of hitting upon the thinnest five? Approximately one in ten billion!

Nor is this all. If actually from our supply, the five written cards were subject to my preliminary selection as well as to the final one by the "spirits," the figure for selection from among 500 then applies, rather than that from among 100. If, as appears the fact, they are really the thinnest five of the entire lot, the chance of their accidental choice is one in 150 trillions!

Ninety of our cards (the full length ones, as used at our first sitting) weigh 9.4 ounces. One ounce being equivalent to 28.35 grams, the weight per card may be calculated to be 2.96 grams, on the average. The medium's cards, as we are obliged to weigh them, carry the writing, which has a very appreciable weight when measured on a delicate chemical balance. But, even with this handicap, our cards are heavier than hers. Weighing five of ours, of average thickness, against her five, gives a differential in our favor of 0.179 grams—say .18 grams, for round numbers. This comes to 0.036 grams per card, or 1¼ per cent. If we could weigh the medium's cards without the writing we should certainly double this, at the very least.

Finally, the texture of the written-on cards is quite different from that of the cards supplied by us. Our stationer has examined both kinds with his expert eye, and has made affidavit that the cards which I showed him as ours were actually of those supplied by him, while the five that carry the writing were not supplied by him, and are of altogether different stock.

The case, strictly speaking, is complete with this showing; but there are other points of extreme interest. In the first place, many readers will doubtless feel that it ought to be explained how the medium *could* practice substitution under our very eyes. Not necessarily how she *did*, but at least how she *could*. On this point a preliminary remark is in order. Our conditions are in no case worked out with the view of preventing a medium from operating fraudulently. The last thing we want is to be obliged to report that no phenomena were produced. If the medium is a fraud, our task is to make him think that it is safe for him to do his stuff, while at the same time providing means for detecting him. It was with this viewpoint that we set up the conditions for Mrs. Y's performance. Fake or genuine we had to have conditions under which she could and would work.




"Mrs. M" stands for the medium's traveling companion. Mrs. Kirby and Mr. Woertz are members of Mrs. Wayburn's family, and Mrs. Empey was her guest. Mr. Ingalls is a contributor to our columns and Mr. Jones a New York *Times* reporter. The other sitters need no introduction.

**The arrangement of the group at the critical moment in the Bayside seance, when for the first time in four sessions the opportunity for substitution existed**

We should not have searched her at all, save at her own insistence. She did insist, on the first sitting in our office; and Mrs. Bird, Mrs. Lescarboura and three stenographers disrobed and examined her, to their best ability, in a private office. She did not insist at the second or third sitting; but at Bayside she did insist. Mrs. Wayburn and her mother accordingly did the honors. Mrs. Wayburn reports that, after being searched, but before resuming all her garments, the medium stepped into the bathroom, alone, for a short time.

A skilled operator would, we believe, have confidence that she would be able to conceal a few small index cards where no amateur searcher could find them. But they would then doubtless be inaccessible to herself. She would need a moment alone, before getting herself fully clothed, to transfer them to a more convenient place, which had already been searched. Or she might have planted them in the bathroom before the search and gone there partly dressed to recover and conceal them on her person. The circumstances were such as to make this possible, but we prefer the other alternative. In any event, we must insist that our "search" of the medium be not taken seriously.

On the lawn, the medium complained of the chill, though in our office she had found warmth rather than coolness uncomfortable and inhibitive. She asked for an overcoat, and Mr. Jones supplied his—a regular horse-blanket of an overcoat, with immense pockets. The medium "warmed her hands" in those pockets, and wore the coat throughout the sitting.

For the critical moment when the final step of the substitution was achieved, I must fall back on Dr. Prince's observations. At all sittings he had been watching for the occurrence of a blind angle, behind or beside the medium, so placed that in their positions of the moment none of the sitters could see into it. In our office, when not actually surrounded by the audience, the medium had faced such a wide semi-circle that no blind spot could exist. Moreover, her back was to an open court, across which our clerks were looking on. Mrs. Y was uneasy and suspicious about this, even after we drew the curtains on the offending windows.

At Bayside, after several rearrangements, the condition diagrammed was ultimately brought about, with the audience in a long narrow horseshoe, Dr. Carrington on one horn and his immediate neighbors robbed of some freedom of motion by the fact that they sat together on benches rather than alone on chairs. From here I quote Dr. Prince's report to me:

"Mrs. Y's practice is to place the pack upon the head of some person present; and she has made great show of holding out her left arm at the supposedly decisive moment, to show that it has nothing to do with the phenomena. But finally at Bayside, when Dr. Carrington was seated at the extreme right of the semi-circle, she placed the cards upon his head, taking a position which shielded her left side from the entire company. At this moment I saw that her left arm was at her side, contrary to her usual practice. She then brought the pack of cards in her right hand down to her left, while the latter was still shielded; then immediately both hands were

(*Continued on page 441*)

*ON October 16 there were produced for the* SCIENTIFIC AMERICAN *Investigating Committee, by the medium Mrs. Y, five cards with "spirit messages," alleged to be precipitated upon them in coloring matter extracted by the psychic operators from flowers and a gold bracelet. On critical examination, the Committee finds that these cards are not of the lot supplied by them for this seance, but were brought in and substituted for such cards. This decision is based on the following considerations:*

*I. The cards supplied for this sitting were 4 29/32 and 4 31/32 inches long. Those on which the writing was produced were five inches long, the same size as the cards supplied for a previous sitting, some of which were missing after that sitting.*

*II. The cards on which the writing appears are of a distinctly grayer color than those supplied by the Committee.*

*III. The cards on which the writing appears are, on the average, two ten-thousandths of an inch thinner than those supplied by the Committee.*

*IV. Every card written upon is thinner than any of the cards supplied by the Committee. The chance that this would occur, in accident and by good faith, is one in 150 trillions.*

*V. The cards on which the writing appears weigh, on the average, 0.036 grams less than those supplied by the Committee, in spite of the fact that they must be weighed with the writing. The difference would be at least doubled if this could be avoided.*

*VI. The texture of the written cards, as examined by an expert, is more mottled and less even than that of the cards supplied by the Committee.*

# Our Abrams Investigation—III

## Comments on Our First Test and a Look Ahead to Other Tests and Studies

*By Austin C. Lescarboura*

Managing Editor, SCIENTIFIC AMERICAN; Secretary to the SCIENTIFIC AMERICAN Abrams Investigation Committee

AS WAS to be expected, we have heard from all parts of the country regarding the report of our first test of the electronic reactions diagnosis, which appeared in our November issue. The comments represent three distinct shades of opinion: First, there are the orthodox medical men who, quite naturally, are pleased with the negative results; secondly, there are the electronic practitioners who are obviously disappointed with our findings, but who are just as ready to offer reasons for the negative results; thirdly, there are the laymen who, in the capacity of final arbiters in this matter, are glad that our investigation is under way.

It would be quite impossible to quote the various comments which have been received, but it is our intention here to present in digested form the various shades of opinion and comment which have been presented.

When we first entered this Abrams electronic controversy, it was our original and superficial opinion that the subject matter could be readily dealt with. The claims, fantastic as they might seem in the light of orthodox medicine, could readily be checked up so that a favorable or unfavorable decision would be arrived at in short order. It also appeared to us that we were dealing with but one definite method of diagnosis and treatment, namely, the electronic reactions of Abrams—known as E. R. A., for short. This, of course, would make the matter relatively simple. Instead, and much to our surprise, we have already learned that there are many variations of the electronic reactions diagnosis and treatment. Abrams stands as the originator of this entire technique, but there are many departures from his teachings. Here and there we find entirely different methods of harnessing the electronic reactions, so that it becomes necessary to differentiate between the true Abrams electronic reactions and those of other brands.

And so we hasten to reiterate at this time that the equipment and the methods employed by Dr. X, who cooperated with us in our first test of the electronic reactions diagnosis, are not those employed and recommended by Dr. Abrams. The air-column method of percussing, which we described at length in the report, is no longer employed by the Abrams practitioners who have better methods, so they claim, of detecting the electronic reactions of the human reagent. The equipment used for our first test was not manufactured by laboratories and individuals authorized by Dr. Abrams, although, truth to tell, the equipment in question struck our critical eye as being of better workmanship, so far as externals are concerned, than Abrams apparatus which we have seen elsewhere.

Now, then, we are confronted by a curious situation. We must make certain in every test that we are dealing with genuine Abrams equipment and technique, or with some other equipment and technique. Dr. Abrams himself has warned us not to confound his methods with those of others, and to bear in mind that there are over forty "bogus" electronic reactions devices on the market.

To differentiate between the genuine Abrams article and others is not a difficult matter. But our obstacle takes the form of giving the electronic reactions diagnosis an unbiased and thorough test. If we are to listen to Dr. Abrams and his immediate followers, we are told in no uncertain terms that Dr. Abrams himself, and no one else, should receive all our attentions. We are even cautioned against making experiments with the leading exponents of E. R. A., although we are entirely at liberty to get their views and comments regarding the subject matter. And to simplify our investigation, our committee is invited to visit Dr. Abrams at his clinic and laboratories in San Francisco.

A visit to Dr. Abrams and a rigid test of his technique should form an important part of our investigation, it goes without saying. However, our tests must also deal with recognized Abrams practitioners, if for no other reason than the obvious one that the average individual never deals with the originator of this technique but with one of his local representatives. That is the important point. We mean to test the E. R. A. under real, practical, everyday conditions, so as to have a workable decision with regard to the entire question, rather than a theoretical, unfinished, imperfect, and, to speak plainly, "staged" investigation which would leave the laity quite dissatisfied and completely at sea.

We have received from Dr. Abrams a list of recognized E. R. A. practitioners within ready reach of our investigating committee, and we shall make every effort to secure their cooperation in our work. Already, several of them have shown the keenest interest in our work and a willingness to aid in every way. At this writing we are arranging for a test in which a number of recognized Abrams practitioners will take part. A collection of pure germ cultures, prepared according to their instructions but quite without their knowledge, will be diagnosed by these practitioners and their various findings checked up with our list of the cultures. This demonstration will be most interesting. We hope to have the report for our January issue.

So much for the authorized E. R. A. practitioners. But now we come to the real complication. It seems that the electronic reactions technique is far from a perfected thing and that much remains to be learned. Indeed, almost weekly some new "rate" is discovered and some short-cut or better way of diagnosing and treating is developed by an E. R. A. worker. Contrary to the prevailing opinion, Dr. Abrams is by no means responsible for all this technique, for much of it has been contributed by his followers. Most of the E. R. A. workers adhere closely to the Abrams teachings, but here and there an E. R. A. worker strikes out along new lines. In fact, some E. R. A. practitioners are frank to say that they have used Abrams' original teachings to become acquainted with the electronic reactions, and then have developed their own equipment and technique which, if we are to believe them, are far in advance of those of the originator.

Now the point is that these distinct variations from the Abrams technique cannot be ignored for a moment. While our investigation is termed an "Abrams" investigation, it now develops into an investigation of the electronic reactions proper, taking in all manner of equipment and technique which still bear some semblance to the E. R. A.

Some E. R. A. practitioners whom we have met have impressed us with the fact that they, rather than Dr. Abrams, can give us a convincing demonstration of the merits of the electronic reactions. They have told us that Dr. Abrams has discovered a wonderful thing, but that he has not developed it to the full. Meanwhile, after they became acquainted with the fundamental truths and the original technique of Abrams, they have forged ahead with their own equipment and technique and have left Abrams some distance behind in electronic reactions practice. Some have boldly set up their own technique and have broken off entirely with Dr. Abrams, while others still retain the right to use the E. R. A. designation, but are frank to state that their methods deviate sufficiently from those of Abrams to make their work that much better.

Efforts have been made over and over again to impress us with the fact that these electronic reactions workers are far better exponents of the fundamental discoveries and possibilities of Dr. Abrams than Abrams himself. Indeed, we have been asked to devote the better part of our tests to these improved methods which, we are assured, will give us positive results where Abrams himself would perhaps fail.

Much the same may be said for the equipment employed. We have received numerous pieces of literature put out by manufacturers of electronic equipment, the writers of which have displayed real art in inspiring the reader's confidence in the electronic reactions on the one hand, and then, by subtle argument, swinging over the reader to some particular kind of apparatus which gets results when the others fail completely. We were somewhat thrilled when we received what appeared to be a real, scientific, and thoroughly comprehensive report on electronic diagnosis and treatment of disease, written by a consulting electrical engineer. The title page and the diagrams led us to believe that here, at last, was a serious report on the subject which would throw considerable light on the intricacies of the electronic technique, by giving us the salient facts in simonpure English. Much to our disappointment, however, the report goes on to tell us that there is something in the teachings of Abrams, but that the existing apparatus is crude and unreliable, and that there is better apparatus now available which will give positive results. Subsequently, by another mail, we receive a bulletin announcing NEW apparatus for electronic diagnosis and treatment, in which all the former drawbacks and imperfections have been obviated and many novel improvements have been made. Needless to say, this bulletin comes from the same source as the report already mentioned.

Hence we shall have to devote our attention not only to Dr. Abrams and his E. R. A. workers, but to other electronic workers who claim to have something better than the original technique. Furthermore, we shall have to disregard the personal equation in our investigation. Merely to scratch the surface of the Abrams question soon discloses that there is little love lost between the various electronic practitioners, and that their references to one another are most uncomplimentary but at all times in perfect reciprocity.

Returning to the comments on our first test, the E. R. A. and other electronic practitioners seem agreed that Dr. X did not know what he was doing. "Why report findings of from 49 ohms to 153 ohms of streptococcic infection, when less than two ohms is as high as these infections can ever go?" asks an E. R. A. worker in criticizing our test and our findings. Others have brought the same point to our attention. Our reply is that we did not determine these readings. They were given to us by Dr. X himself, working at his rheostats. It does seem, however, that due allowance must be made for the fact that Dr. X was working on pure germ cultures, instead of a tiny speck of blood; that should make some difference in the ohmages.

We have been seriously reprimanded for giving any attention whatsoever to Dr. X, since he is not a recognized E. R. A. worker. What we have already stated in the foregoing account of the electronic situation as we found it to exist, explains why we must make tests wherever we believe we can learn something regarding electronic technique. Dr. X, who has been giving electronic treatments to a large clientele in New York City and has recently developed new equipment for which he makes revolutionary claims, was the first to come forward and extend his cooperation to our investigating committee.

We have been criticized for not mentioning Dr. X's name, but we believe that it is best, for many reasons, not to mention names in an investigation of this kind. If our findings in any one test are adverse, it is best not to mention names. If our findings are favorable, again it is best not to mention names. We are not investigating one doctor or another; we are investigating electronic medicine as a whole. The doctors and E. R. A. workers and other electronic workers are invited to cooperate with us, so that we may present the true story of electronic medicine to our readers.

*(Continued on page 448)*

**AN investigation of the electronic reactions of Abrams and other electronic methods of diagnosis and treatment has been undertaken by the SCIENTIFIC AMERICAN. A committee of competent, unbiased, keenly interested scientists will formulate the various tests to be undertaken as well as pass upon the results obtained. The investigation is based primarily on obtaining first-hand data as the result of our own tests and observation. We are investigating the electronic technique as a whole, and not the individual practitioner. We invite the cooperation of everyone, in order that the true facts may be presented to the public.**

# The Last Harbor of Forgotten Ships

## Where Old-Time Clipper and Modern Submarine Chaser Meet for the Attention of the Salvager

ALONG a goodly stretch of the west bank of the Hudson River, just north of Weehawken, New Jersey, is to be found a typical graveyard — the last resting place of forgotten ships. Here, vessels that have done good service in their day and have fought their way through wind and weather for many a long year, have found a last resting place. It is a weird and miscellaneous gathering of derelicts, a veritable museum of types of all periods and of every manner of construction. If there is any future life for these vessels, it lies in the salvage which is taken out of them; for their iron is recast or reworked, to do service in many of the different arts; their timbers also are used for structural purposes, sometimes even to shelter man once more from the milder mischances of wind and weather upon the shore; while the richest of all treasure trove is the copper and brass which find their way into arts too numerous to mention.

Remains of the historic old "Granite State," ready for the salvager. The timbers in old ships such as this one find a variety of uses

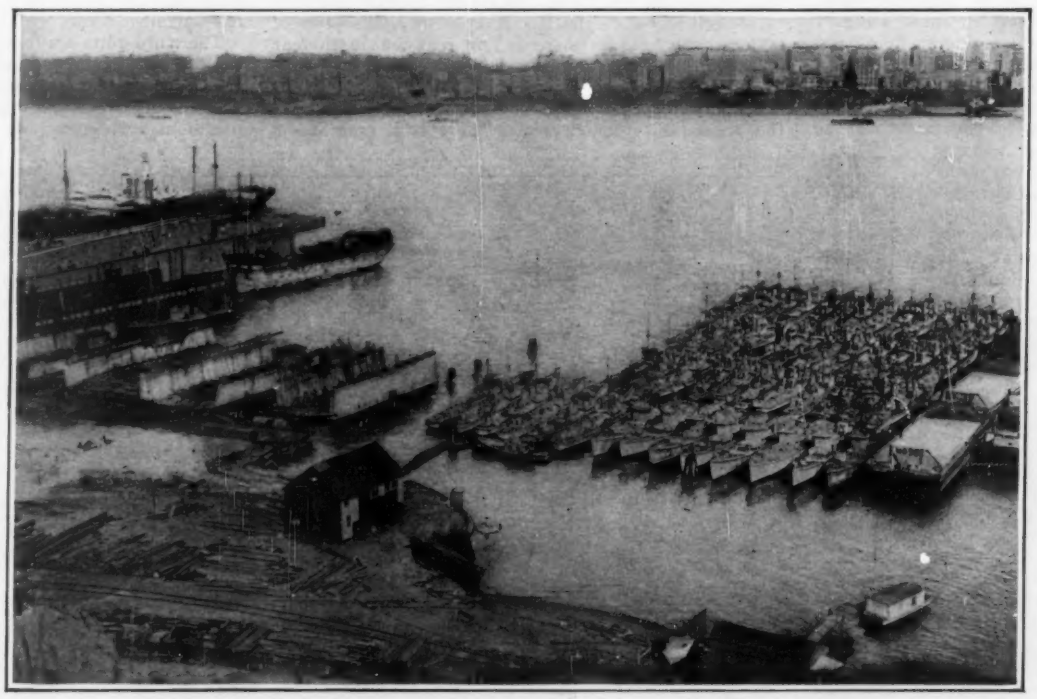
Perhaps the most appealing among these works are the fine sailing vessels which stand there, gaunt and stiff, like fine old aristocrats of a former day, with their graceful prows lifting high above the water. With the coming of the war, these old sailing ships found a use; and from out of harbors here and there along the coast, came to do service as freight carriers. Their period of service, however, was short; and at the close of the war many that were not sold abroad found their way to the graveyard.

Many types are included among these old sailing ships. Among them are representatives of those beautiful vessels, the clippers of the fifties and sixties, probably the most perfect merchant craft that were ever propelled by sails. In their day, the best of them surpassed the steamships in speed. That was in the period when the United States stood in the forefront of the ocean-carrying trade. For many months, one of the most interesting of the derelicts was the "Granite State," which was brought over here from across the river, after being burned at her dock, to be broken up for the copper, brass, etc., that was in her. Subsequently, while being towed north for final breaking up, the "Granite State" caught fire again and went to the bottom. This representative of the old three-deckers dated from the time of sail power and the smooth-bore. Not far from her stands what was once the flagship of the New York Yacht Club, the "Electra." In her dismantled condition, she is hardly recognizable, and seems to be a symbol of the familiar tragedy which made her owners wish never to see her again. Then we notice the old floating dry docks, dating from Heaven only knows how many decades ago. And of course the lighter, that indispensable element of harbor traffic, forms a conspicuous part of the assembled ships. Here also are to be found canal barges, some of which must, from the look of them, date back almost to the opening of the Erie Canal. Farther along the shore we see the "Hatteras," its name recalling the gaieties of fifty years ago, when she was the queen of river boats and her decks, as she went up and down the quiet waters of the Hudson, resounded with music and the shuffling steps of the dances popular in those days. Close by is another famous boat, the old excursion barge, the "Columbia," memorable in the minds of the sporting fraternity from the fact that here John L. Sullivan fought one of his famous battles.

Of course, the most striking group of vessels is the closely packed fleet of submarine chasers, sixty of which were bought up after the war as a speculation. It was thought that there would be a demand for them as pleasure craft; but very few have found their way into the yacht clubs.

In closing, it may be mentioned that the spot chosen for this graveyard of ships is itself historic. In the adjacent country campaigns of the Revolutionary War were conducted, and on the heights above, placards tell the stories of battles and skirmishes.

Here, too, there are thrilling memories of meetings between the white settlers and the Indians, and of deplorable massacres. The most melancholy association of this spot is the death of Alexander Hamilton, that organizing genius of our young democracy. On the cliffs above he fought a so-called duel with Aaron Burr and with his pistol in the air received the fatal bullet of that sinister character of our early history.



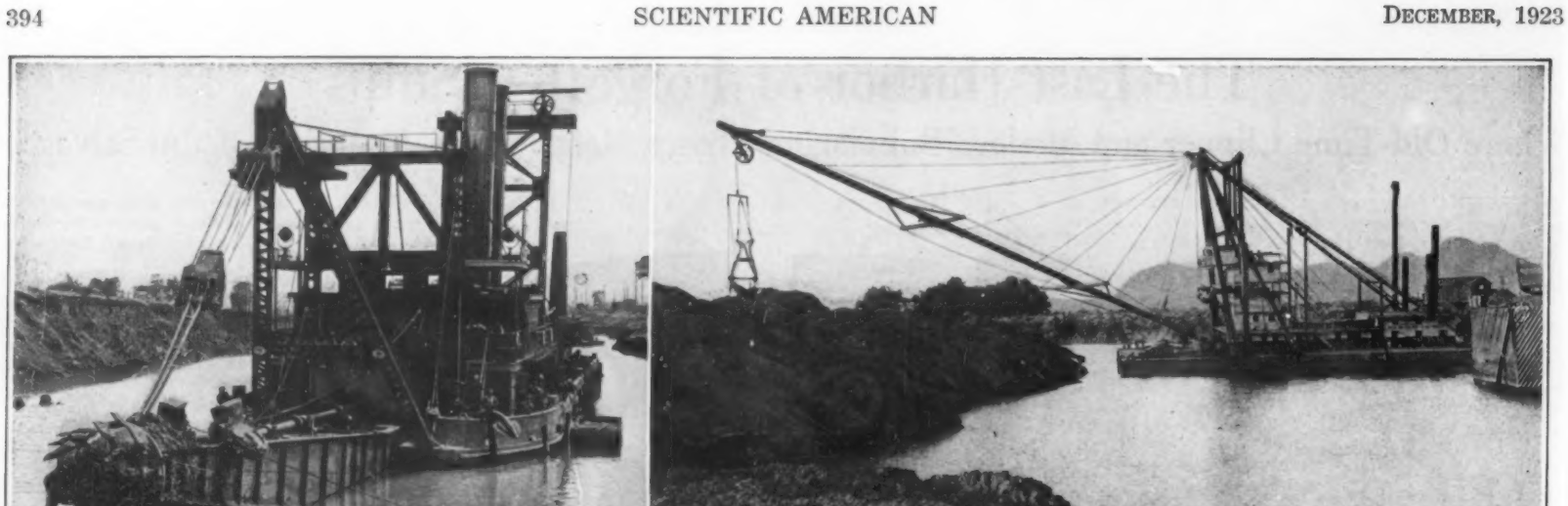
General view of a section of the ship graveyard, with a large fleet of submarine chasers in the right foreground. The background is formed by the up-town section of Manhattan Island

### Copenhagen-Bornholm Wireless Telephone Service

THE island of Bornholm, which so far enjoyed no telephone or telegraph communication with the rest of Denmark, has just been connected with Copenhagen by a combination of radio and wired telephone systems, subscribers at both ends communicating with one another without any special apparatus merely by calling up the exchange in the usual manner. While the transmission of weak telephone currents to the radio transmitting station and, in a similar manner, the transfer of feeble receiving impulses to the telephone line at the receiving end entailed a suitable amplification by means of vacuum valves, special difficulties had to be overcome in insuring a duplex service, *i.e.*, the possibility of simultaneous transmitting and receiving without any mutual interference and without any necessity for the subscriber to switch over from one service to the other. The proper distribution of the speaking and listening currents is effected by means of a "distributor" working on the Wheatstone bridge principle.

A new Lorenz-Poulsen transmitting station has been provided near Lyngby at the Copenhagen end, an isolated loop aerial on a 25-meter mast being used to receive the electric waves. The receiving plant is installed in the island of Amager, to the southeast of the Danish capital. At the Bornholm end, another Lorenz-Poulsen transmitter has been installed at Hammeren, in the northern angle of the island, the receiver being situated near Rönne Harbor, on the western coast.

Successful radio telephone tests between the Copenhagen and Bornholm apparatus, on the one hand, and Berlin, on the other, were made previous to the opening of the new service, thus demonstrating its possibilities under conditions more exacting than the daily routine. Other tests were made between Copenhagen and the American steamer "United States," whose captain, while on the high sea, remained in permanent telephone communication with Copenhagen telephone subscribers, very much like our tests with the S. S. "America."



*Left:* The suction dredge "Cyclone," the property of the Toronto Harbor authorities but loaned to the contractors for the Queenston-Chippawa power project. *Right:* The dredge "Mars" closing a levee break north of Sacramento (1915)

**Two famous dredges engaged in important work**

# Some Great Dredges

## Monster Grab-Buckets that are Able to take Fifty Tons of Mud and Rock at a Single Bite

*By J. F. Springer*

EXCAVATING apparatus has been greatly developed because of the demands made by general construction in the United States and Europe, particularly such great works as the Suez Canal, the Chicago Drainage Canal and the Panama Canal. The steam shovel is largely responsible for the success at Panama in cutting through the dividing ridge separating the oceans. The dredge cut the canal in the fresh and salt water sections and built a great part of the monster Gatun Dam. If a slide, big or little, occurs, it is the dredge which is relied on to open up the great waterway again.

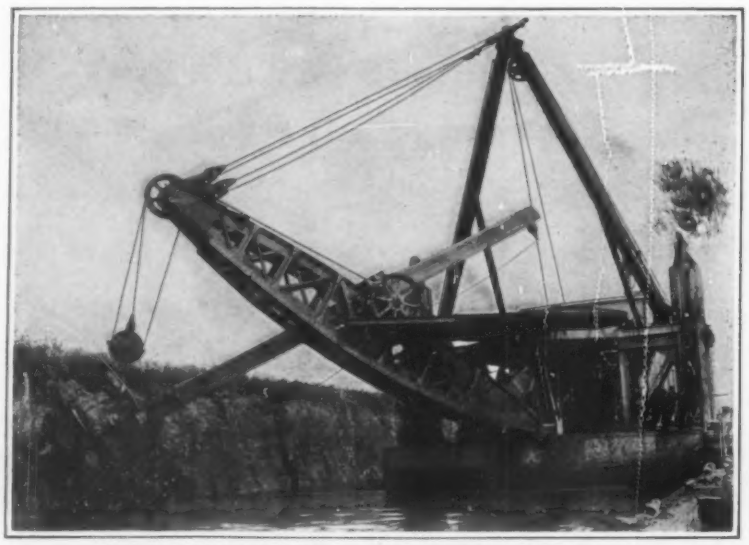
All over the country, dredges are more or less in use. They float from point to point, and excavate soft and hard material. On the Panama Canal, though the big ditch has been completed for a number of years, serious excavation is still going on. From the canal prism itself, some 3,711,819 cubic yards of earth and rock material were removed in the fiscal year ending June 30, 1920. All of this, in addition to auxiliary work, was done by six big dredges, three of them being of the dipper type and three of the pipe-line suction class. The dipper dredges—the "Paraiso," "Gamboa" and "Cascadas"—are giants. The great dipper on each has a rated capacity of 15 cubic yards. It is big enough, when set with the opening up, to permit 34 men to stand, without undue crowding, upon a platform suspended inside the great opening. The "Paraiso" was one day engaged in its work, the great hull, from which the gigantic arm and dipper are operated, floating quietly on the smooth water. The operator had no notice of anything unusual until he saw a stone appearing above the surface. It was a monster 50-ton stone that was being brought up by the dipper. No shock or tremor seems to have been felt on the vessel when the dipper secured its great load. The stone must have weighed, even when totally submerged, around 30 tons. Upon emergence the weight naturally went up to the 50 tons. A mighty machine, indeed, that can take in so quietly at the end of a long lever such a weight as 30 tons and that is not disturbed when this weight grows to 50 tons. It was thought rather unsafe to put the stone in one piece on the attendant scow. In fact it was blasted three times while still on the dipper, and thus reduced to manageable sizes. In nine months in the fiscal year just mentioned, this same "Paraiso" excavated 947,360 cubic yards of material, over half of which was rock. The unit cost is estimated at having been $0.44109 per cubic yard. The sister dredges also did great work, though at costs somewhat higher.

The pipe-line dredges are also big fellows and competent to the performance of severe service.

Some may wonder that so much work is going on at Panama. Part of the work consists of new construction and part is to be classed under "maintenance." As a matter of fact, the new construction amounts to only a small percentage of the whole. Upon July 1, 1920, there yet remained to be taken out of the prism of the canal the very considerable amount of 3,286,900 cubic yards of earth and rock. This material may be classed as siltage, material from slides, and original material. Really, the canal will never be done, even when there are no more slides and when all original material has been taken out and away. Gatun Lake, through which a very large part of the canal runs, is the recipient of waters belonging to the old Chagres River. The torrential streams thus made tributary to the lake bring down naturally their quotas of material from their several watersheds. However, it will probably be some time before the last slide becomes a matter of history. As long as there is any real reason to fear a considerable slide, the dredging capacity will have to be kept at a pretty high level.

Dipper dredges operate much after the manner of the regulation steam shovel. There is a great boom which furnishes a fulcrum for the operation of the arm at one of whose ends the bucket is attached. A rope, secured to the bucket and passed over a wheel at the end of the boom and thence carried back to a drum on board the vessel, provides the means of swinging the dipper-arm. The dipper is continually open on the side next the material to be secured. On the opposite side is a bottom hinged on the side next the arm. Ordinarily, the load, when secured, lies inside the bucket. It is dumped by releasing the hinged bottom, where the material drops onto the pile or scow. The action is entirely different from that of the pipe-line suction dredge. In this case, the material is sucked in through an opening and then pumped on through a pipe line. By the use of relay pumps, the material, together with a quantity of water, may be conveyed long distances and to elevated positions. In the original construction of the Panama Canal, part at least of the material for Gatun Dam naturally had to be elevated. In certain comparatively recent work on the canal, the dredges were just about a mile distant from the outfall.

There are quite a number of varieties of dredges. On the Pacific Coast, for example, recent years have seen the introduction and use of big clam-shell dredges. The clam-shell excavating bucket has been found very useful in dry excavation, and in the handling of coal. It and the orange-peel bucket have also been found serviceable in wet excavation. The clam-shell bucket consists of two halves which open from and close upon each other much as do the valves of a clam. A good type of bucket will bite into the material being excavated and thus secure a good load. That is, they dig as well as shovel.

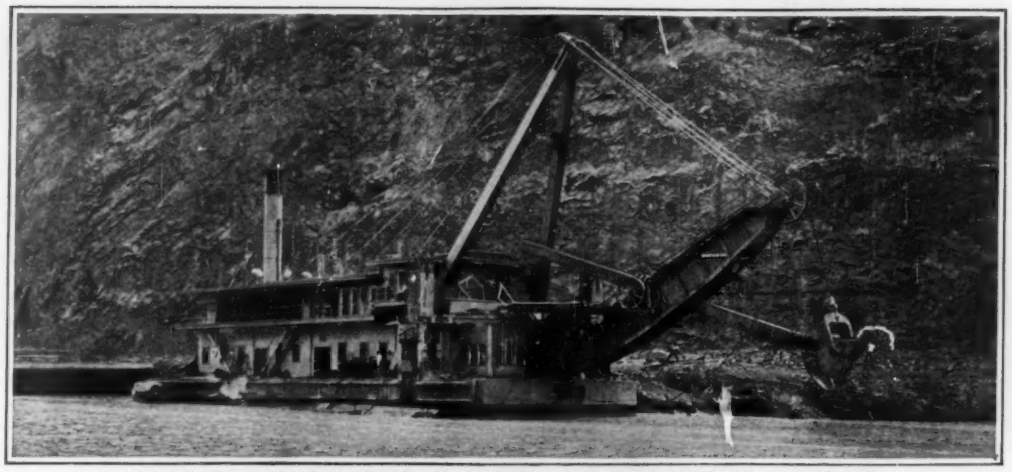


**Dipper dredge of eight cubic yards capacity at work in the Chicago Drainage Canal**

On the Sacramento River, certain big dredges, as the "Neptune" and "Mars," have been doing great service. Naturally, the vessel must be a considerable affair. It is provided with an A-frame or an equivalent as a means of providing locations from which a great boom may be operated. This boom may have the enormous length of 240 feet, and the bucket operated from its outer end may have a capacity of 8 cubic yards. This is but little more than half the capacity of the three monster dipper buckets on the Panama Canal giants. On the other hand, a boom of 240 feet has a reach far beyond anything possible with the dipper dredges. In fact, the latter must discharge close-by, as on to an attendant scow; while a long boom operating a clam-shell bucket may operate in a pretty wide waterway and still deliver material

secured ("spoil") to either bank. It is said that canals having a width on the bottom of 500 feet have been constructed by this type of dredge without requiring any rehandling of the spoil.

Ordinarily, the boom is set with its outer end at the desired level and is then not lifted nor lowered while the bucket gets and discharges its load. The boom is, however, swung in a horizontal plane, thus enabling the bucket to carry the material to the shore and to return to the excavating point.



15-yard dipper dredge "Gamboa" at work on Cucuracha Slide, Panama Canal

An interesting feature of these great dredges is the enormous boom having a length of 240 feet. Timber is used in the construction, and is in fact believed to be the only suitable material for the severe service calling for great elasticity. This size of boom is made up by using sections 110 feet long. The joint is made by scarfing the ends and then bolting them together. The length of such a joint is 27 feet. In order to control lateral bending, the booms are strengthened by means of a cable which passes through saddles arranged on the ends of cross-arm struts. There is a certain amount of slippage permitted and this gives a degree of flexibility. Numerous guys run from the A-frame to points along the length of the boom and at ends of the struts and thus add to the power of resistance to loads at the end of the boom. In fact, prior to the attachment of the bucket, the guys are so adjusted as to lift the far end a distance of 2 feet. This is to compensate more or less completely for the bending consequent upon the weight of the bucket and its load.

An interesting feature concerns the method of compensating for the dip of the boom consequent on the list of the vessel when the boom with its load is swung. It has been found that the overhang of the A-frame has a tendency to elevate the boom when it is swung. As this is a tendency the opposite of that produced by the list, it may be utilized for the desired purpose. It is, however, necessary to adjust the overhang to just the right amount to produce the best results. It is understood that it is possible so to put the one thing against the other with each particular dredge as to make it practicable to swing the loaded boom end in a substantially horizontal plane. The operation of the booms is controlled by the use of two cables running through sheaves at the ends of the booms. When the earlier designs were in use, the high winds which often prevail over the lower section of the river made it difficult or next to impossible to operate the dredges during their continuance. But now, a recent improvement has been adopted, which consists of providing water ballast tanks along both sides of the vessel. These tanks can be operated in such manner in conjunction with the overhang as to offset an athwartships wind and thus permit the boom to be worked somewhat as usual.

Another advance in design is one that concerns the operation of the two control cables. A great variation in the positions of the cables is required in order to control the boom in widely different locations. A pair of sheaves was, in the earlier dredges, attached to each of the two sides of the A-frame down near the base. These sheaves, known as "sister sheaves," were to provide sheave action whenever possible. It was found, however, that one or more times during every cycle of operations, the cable would cut across the flange of a sheave and suffer abrasion in consequence. The improvement in design consists in the use of a single counterbalanced sheave which is so designed that it automatically adjusts itself to any and all positions without inducing more than one bend in the cable. This change has resulted, it is understood, in a considerable prolongation of the life of the cables.

An idea of the size of these dredges may be got by a consideration of some principal figures. The "Neptune," for example, is about 150 feet long and 70 wide. The depth is 13 feet. The top of the A-frame rises about 82 feet above the deck. At the apex of the A is attached the topping cable—that is, the cable which lifts the boom. It is rigged in 10 parts and consists of a galvanized steel rope 1⅜ inches in diameter. It is estimated that the stress on this cable when the bucket is loaded is about 110 tons. The bucket itself weighs 15 tons and the load about 12 tons. The boom is a heavy affair weighing around 12 tons. The cable acts at a disadvantage because its angle of elevation above the horizontal is necessarily a flat one, and this is the reason why a weight of 27 tons plus some additions from the boom is able to produce a stress of 110 tons. Certain "hog rods," 3½ inches in diameter, have the duty of holding the A-frame. It is said that these rods endure, at the time when a full load is swung the maximum distance on one side, a stress of 145 to 160 tons. The legs of the A-frame are likewise put under severe compressive stresses at the same time.

That there must be nothing faulty in the rigidity of the construction will perhaps be glimpsed when it is learned that such dredges as the "Neptune" and the "Mars" are operated 24 hours per day and that a cycle of operations is gone through with in from 103 to 120 seconds. The big dipper dredges at Panama are able to go through a cycle in much less time; when a great struggle was going on to beat the slides, they were put upon a cycle-time of 45 seconds.

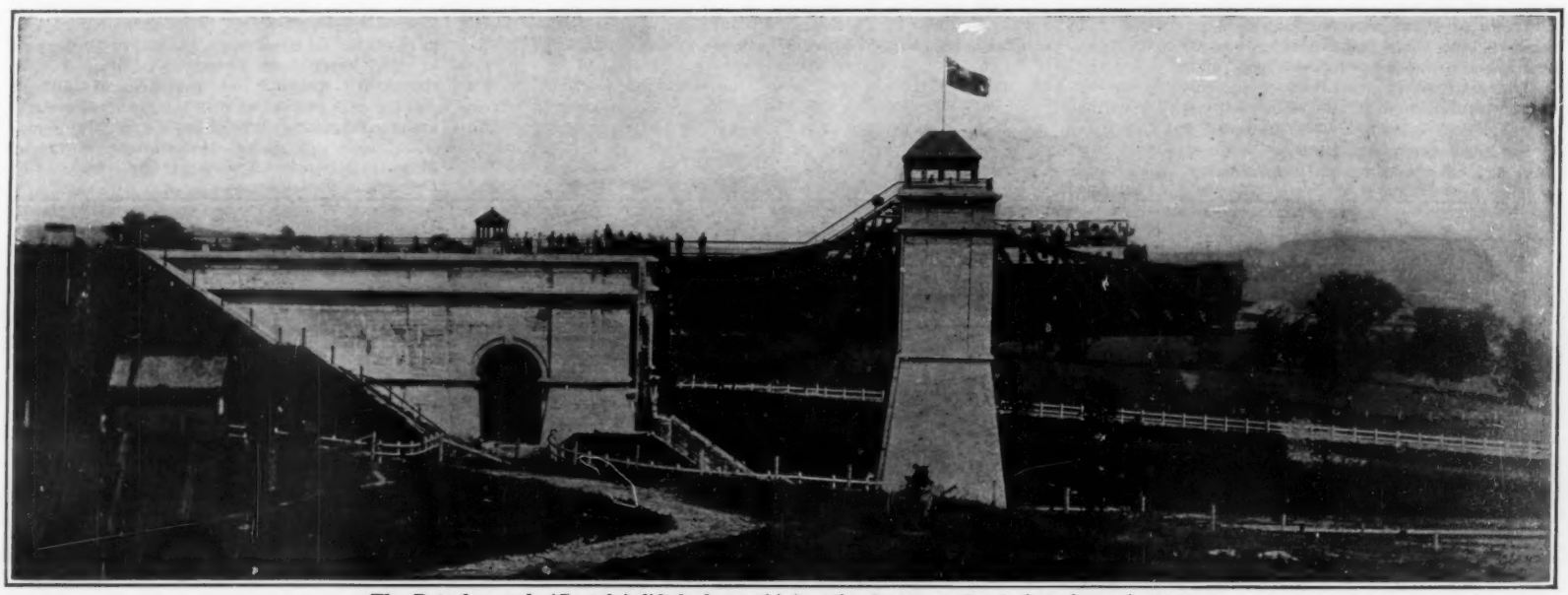
## The Lifting Lock

THERE is more than one interesting variant upon the ordinary canal-lock. Along the line of the Old Morris and Essex Canal, for instance, which climbs the Jersey hills at numerous points, may still be seen the remains of the "canal railways" by means of which these climbs were effected. These are nothing more or less than inclined planes, separating the two levels of the waterway, up which the boats were hauled bodily on a wheeled carriage at the end of a cable. Another, and more finished, expedient, is the one which we illustrate herewith. The photograph is taken at Peterborough, Canada; but similar installations are found here and there throughout the world, and we have a dim recollection of having described one of them before.

In the case of Peterborough, the stream is a part of the Trent water-power development; and, at the same time, it is desired to have the way navigable for barges of moderate size. There is a material descent at Peterborough, one of the points of actual power development. Instead of the ordinary lock, the hydraulic lift is employed. This consists, in effect, of a big elevator, sufficiently large to accommodate any vessel which the stream itself would accommodate. If the lockage is to be in the downward direction, the lift is raised to the upper level, in which position it is adjacent to the regular waterway on this level, and like an ordinary lock, constitutes in effect a continuation of this. The gate between the river and the lift is opened, and water flows in to fill the lift; after which the vessel is admitted and the gate closed. The lift is then lowered to the lower level, where the gate at the other end is opened and the vessel goes its way.

When the lift is being raised, empty, the right-hand gate of our picture is allowed to remain open so that the load of water does not have to be raised too. When it is being lowered empty, the water is allowed to remain in it to aid the lowering with its weight. The system is particularly adapted for use on a power waterway, since it uses less water than the ordinary lock, which has to be filled to its entire depth corresponding to the difference in elevation between the two levels; and the water used for this purpose, in a downward lockage, comes from the power flume.

The Peterborough installation is believed to be the highest of the kind in the world. The lift which we illustrate seems to scale about 60 feet in height when measured against the men standing on the upper level. It raises or lowers a vessel in twelve minutes.



The Peterborough (Canada) lift-lock, combining the features of a lock and an elevator

# Driving the Bomber to High Altitudes

## Latest Guns Make the Air Deadly at 20,000 Feet, and Dangerous at 30,000 Feet

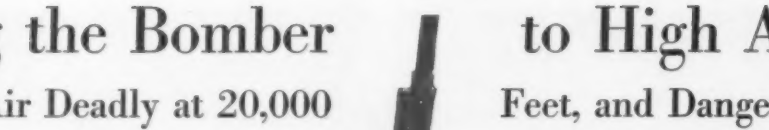
AS MATTERS stand today, no matter how excellent may be the new guns and other military material developed by the Army and Navy, the question of whether the nation shall make and use them is decided by the inexperienced layman.

Before these improved weapons can be built in numbers, the money for their construction must be appropriated, and the appropriations are determined by a Congress that is not, and does not profess to be, scientifically trained. Although this is a wise constitutional provision, it has the serious defect that, due to lack of knowledge or to misinformation, Congress is liable to withhold funds where they are urgently needed, or to grant them for experimental devices which subsequently prove to be useless.

These conditions are always perilous, and they are particularly so today in regard to the military value of airplane bombing. The public is always attracted by the spectacular, and unfortunately the experimental bombing of battleships, as carried out two years ago and this year off the Virginia coast, when several anchored battleships and cruisers were sunk, has made such an impression on the minds of those who undertake to write about Navy and military matters that they have proclaimed the battleship as already doomed and the airplane as supreme—"Why build a battleship costing $40,000,000 when an airplane costing the merest fraction of that sum can sink it with a single bomb?"

There are two major fallacies in talk of this kind. First, the ignoring of the fact that the battleships attacked were anchored; the second, that they were provided with no means of defense whatsoever. The death of these battleships was as certain as is the death of an ox when it is struck by the poleaxe of the butcher.

Much has been made of the fact that a vast amount of anti-aircraft ammunition was expended in the world war to very little effect; but the anti-aircraft guns of 1914 to 1918 were feeble weapons compared with the anti-aircraft artillery which has been developed since the armistice. Enemy airplanes during the war were accustomed to fly over hostile territory at low elevation with comparative immunity, for the reason that the range of the anti-aircraft artillery and its rapidity and accuracy of fire were limited. Today the low wartime zones of flight would be literally sprayed with machine gun bullets and with a barrage of bursting shrapnel. Moreover, what is true of the land fighting of the future is true also of fighting upon the seas. The battleship will bristle with machine guns with a maximum vertical range of 12,000 feet, and with automatic guns firing 1½-inch high explosive shells with a maximum range of 14,000 feet. Three-inch guns have been developed by the army which are effective at 21,000 feet and 4.7-inch guns with a vertical range of 30,000 feet. Furthermore, it must be remembered that the shells from these weapons, thanks to tracer ammunition, leave a visible trail of smoke behind them and are capable of being brought to bear directly upon enemy airplanes up to ranges of 7500 feet, 14,000 feet and 21,000 feet. Now, if in the bombing experiments off the Virginia coast effective hits could be made only at elevations of from 3000 to 6000 feet, and then only because there was no interference from the helpless battleships below, what kind of shooting would have been done had the air been sown with machine gun bullets, shells and shrapnel, effective at 7500 feet to 21,000 feet? We doubt if a hit would have been made.



Our 3-inch anti-aircraft gun, Model 1920, in the firing position

Gentle reader, whenever a so-called naval or expert military writer tells you that the battleship is doomed and that aircraft are masters of the sea and shore and sky alike, be so good as to remember the facts given above, and cease either to be misled or worried by these wild and altogether unjustified statements that the battleship is doomed and that all future attack and defense will take place in the air.

New 50-caliber water-cooled machine gun. Vertical range 9000 to 12,000 feet. Fires 500 shots a minute

In referring to the great altitudes to which anti-aircraft guns have attained, we have in mind particularly the new weapons which have been developed by our Coast Artillery, assisted by the Ordnance Department. The description of these guns, as given below, reveals, it will be seen, a truly marvelous advance over the anti-aircraft artillery of the war; and it is certain that the difficulty of making direct hits with bombs on a specified object, such as a ship or a fort, has been greatly increased by the high altitudes at which the bombing craft will have to operate.

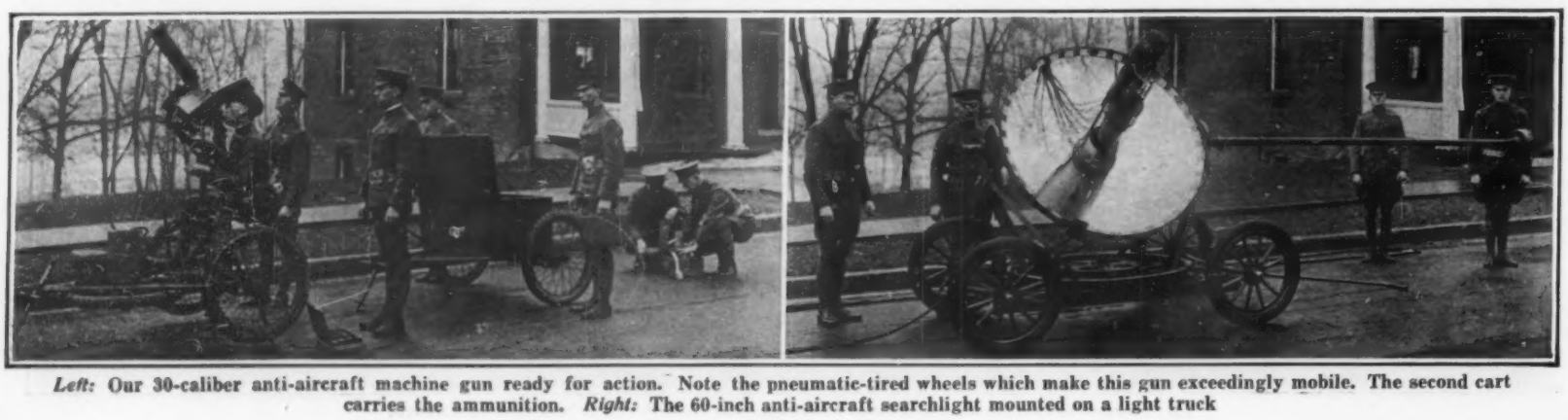
There are four new types of anti-aircraft guns now in process of development. The first of the new guns is the 50-caliber machine gun with a horizontal range of about 27,000 feet, a straight-up range of 9000 to 12,000 feet and a rate of fire of about 500 shots a minute. (So far as we know, no data are as yet available from which can be determined the degree of accuracy which might be expected of bomb dropping from anything like an altitude of 9000 feet.) Fire control is to be maintained with this gun through new tracer ammunition, visible night or day up to 7500 feet. (Surely this method of fire control—really nothing more than playing a hose—can be exercised from the deck of a battleship.) The 50-caliber gun is under manufacture for issue as a substitute for the 30-caliber weapon, now used.

The second gun under development is a 37 mm. machine gun, firing high explosive shells with fuses so delicately adjusted that the shells, while safe to handle before firing, *explode on contact with balloon fabric* once they have been discharged from the gun. A rate of fire of 100 to 120 shots a minute is expected with this weapon, with a straight-up range of 14,000 feet and tracer ammunition visible up to 10,000 feet, making possible accurate firing up to that point. It may be said that, at this time, this is a future prospect. This is true, but the handwriting on the wall says that it is time for the Air Service to begin demonstrating what they can do in the way of bomb dropping at these and still greater altitudes. It is planned to install these weapons in batteries of four, operating with a single telescopic sight control and to be trained and fired by a single gunner. (Another case of "playing the hose"—only this time the hose has four nozzles. Would it be much more difficult to train the ordinary "Jack Tar" to play this hose accurately on an airplane, the pilot of which had the hardihood to come within its zone of operations, than to train him to play the usual type of hose on the battleship's deck?)

The third new gun in the group is a 3-inch weapon on a mobile mount with a rate of fire of fifteen shots a minute, effective at altitudes up to 21,000 feet, and with full 360-degree traverse to enable the gunner to follow his target in any direction. It can be fired at an elevation of 80 degrees and has a horizontal range of more than 38,000 feet with projectiles weighing 15 pounds and containing a heavy bursting charge. Guns and mounts of this type are now under test at army proving grounds.

Gun No. 4 in the anti-aircraft list is the 4.7-inch, firing a 45-pound shell to an effective altitude of 30,000 feet. Its horizontal range is in proportion. It is to be mounted on a mobile carriage with full traverse and equipped for power loading and with an automatic breech block to speed up firing. This gun also can be fired at an elevation of 80 degrees, or within 10 degrees of straight over the gunner's head.

The experts are working out a system of indirect aiming, experiments having shown that central control firing is greatly superior to the old systems. Two types of central stations are under development, either of which will materially speed up aiming and firing.

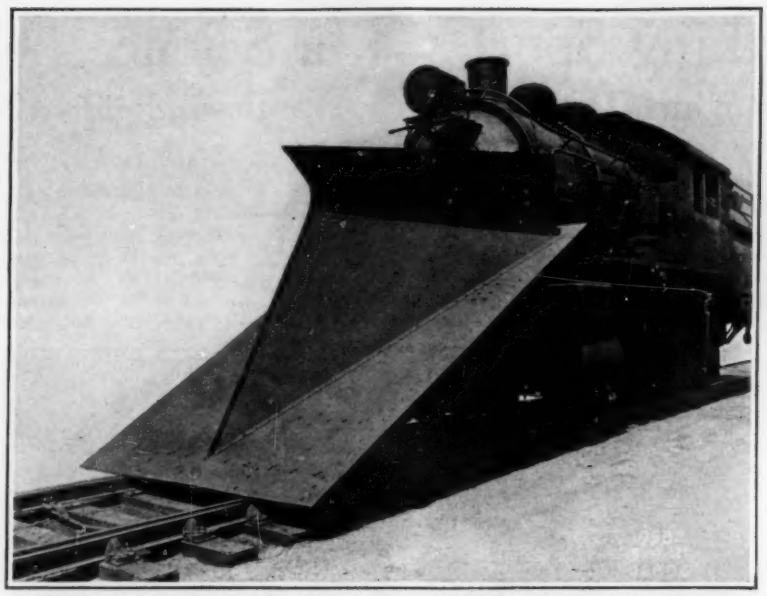


*Left:* Our 30-caliber anti-aircraft machine gun ready for action. Note the pneumatic-tired wheels which make this gun exceedingly mobile. The second cart carries the ammunition. *Right:* The 60-inch anti-aircraft searchlight mounted on a light truck

## All Fixed for a Hard Winter

THAT present winters are, as a class, any different from those of olden days is a fallacy that has been pretty well exploded. Not alone because twice during the past six years we have had extreme instances of what a "temperate" climate can produce in the way of winter tie-ups, but because the long-term constancy of our weather is getting to be more understood on general grounds, the period since the war has seen the development of machinery for combating on a scale hardly before attempted the snow-storm blockade of railroad, of street, and even of the ordinary paved road.

With the advent of the winter of 1921-1922, the management of the Philadelphia and Reading Railroad decided that it would not be caught napping. If any of its trains were to be held up by snow, it was desired to insure in advance that this would be because they had encountered a drift of truly extreme size, and in no sense because they were poorly equipped to do battle with the forces of winter. The rather amazing contraption pictured on the front of the locomotive herewith is the design which has been ultimately worked out with this end in view. Doubt that it would do as well as the powerful rotary in boring its way through extreme snow drifts is met by the statement that it is more immediately intended for the ordinary snow fall of a few inches, or maybe a foot or two, which is to be expected continually throughout a fairly severe winter—that it aims to prevent this from developing into something that only rotaries, good luck and sunshine combined can combat with prospects of success.



**Novel snow plow, expected to be of unusual value in dealing with falls of moderate depth**

## Bumping the Bumper

CONSIDER the bumper. It toils not, nor helps the motor to spin, yet every car owner knows that it is often a valuable thing to have upon his machine. It is usually more bumping than bumped against while in service, but the opposite is true before a tested and "approved" bumper reaches your chassis.

When the companies issuing automobile collision insurance proposed to credit a reduction in the premium where "bumpers approved by the Underwriters' Laboratories are used," the task of testing such attachments appeared to be an easy matter. In actual practice, however, a number of difficulties developed.

It was found, for instance, that it required no less than 400 different shapes, materials and methods to mount a single style of bumper upon the various makes and models of passenger cars. The necessary fixtures or brackets thus presented a big problem in themselves, since manufacturers have never, apparently, considered the desirability of standardizing provisions for bumper mounting. The bumper tests have demonstrated conclusively that brackets holding successfully upon one make of car may fail dismally applied to a chassis of different design.

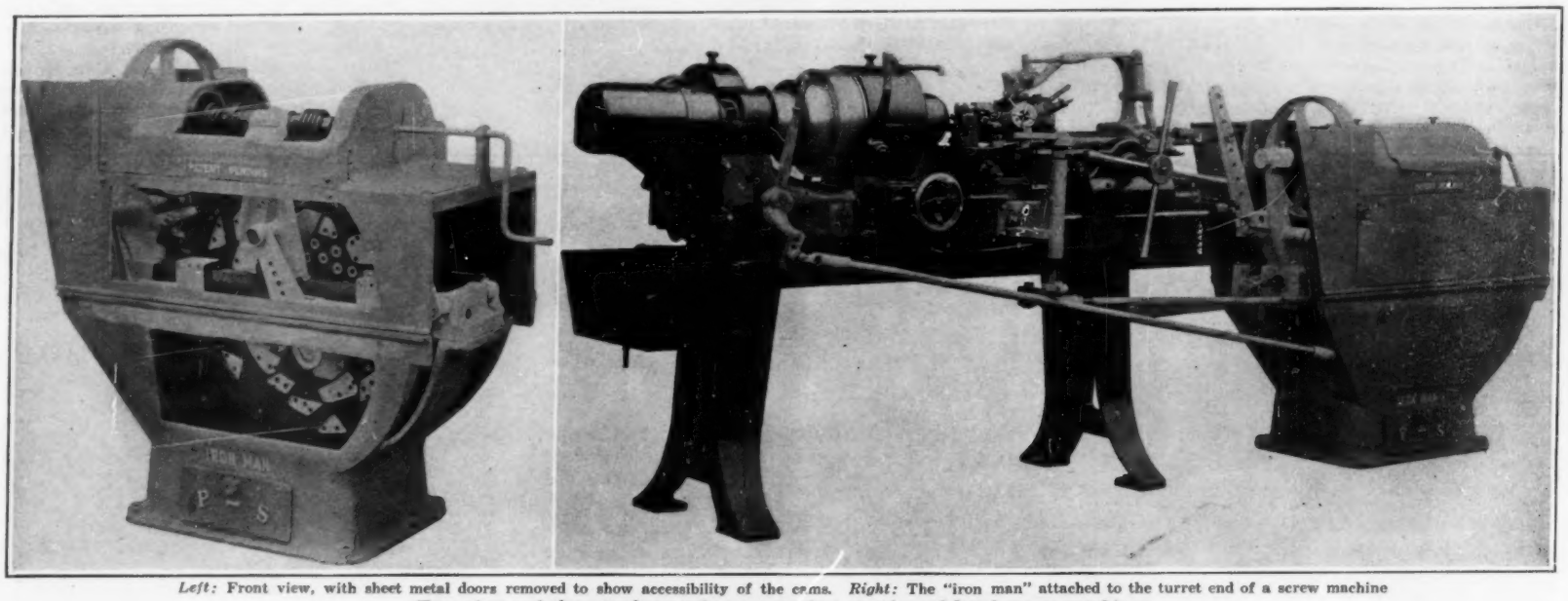
The manner in which the bumpers are "treated rough" is one devised by these engineers. Instead of propelling a car model against a stationary object, a stripped car frame, equipped with the bumper to be tested, as shown in the illustration, is bolted rigidly to a cement floor and made ready for the blow.

The blow is supplied by a short length of 24-inch iron pipe filled with concrete and suspended by steel cables from a point 68 feet above the floor.

When this massive pendulum is pulled back from the perpendicular to a distance of 21 feet and released it rudely swats the bumper with a force estimated to equal the impact of a 4000-pound car traveling at a speed of 4 miles an hour.

Under this test many bumpers have come through smiling. When the weight has been swung over a 30-foot arc, however, not one bumper has survived. They not only crumpled into pretzel-like formations, but failed to protect the radiator from damage. This swing of 35 feet, incidentally, corresponds to the impact of a 4000-pound car running at 8 miles an hour.

The engineers believe that the practice of reversing actual conditions by having the theoretical fire-plug or telegraph pole the moving object, while the automobile remains stationary, may account for the unexpected seriousness of the test results.



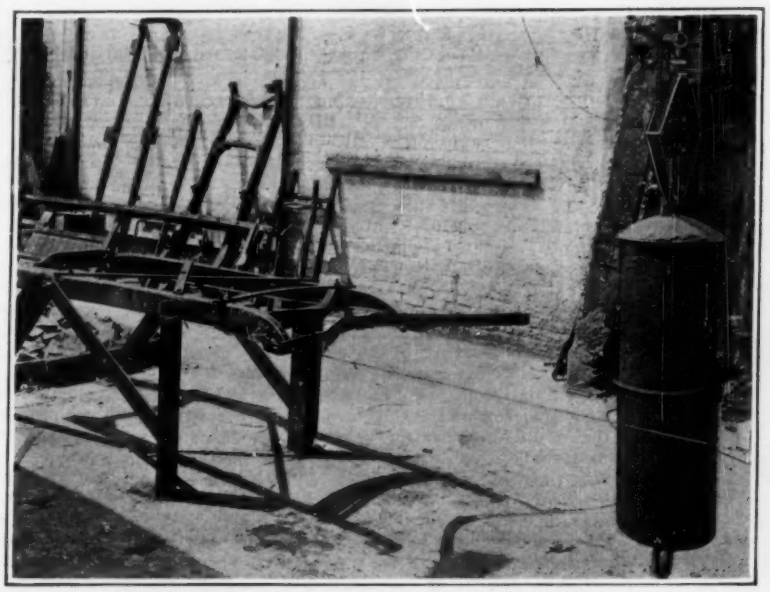

*Left:* Front view, with sheet metal doors removed to show accessibility of the cams. *Right:* The "iron man" attached to the turret end of a screw machine

**Two views of the attachment for automatic operation of hand screw machines**

## For the Hand Screw Machine

ADDITIONS and improvements to hand screw machines have been in the direction of improving the machine itself, or of changing it into an absolute automatic. Now an Indianapolis manufacturer is putting on the market an attachment which does nothing to the machine except to operate it automatically.

The new attachment fairly merits the name of "the iron man" which the maker has bestowed on it. It consists really of a disk, mounted upon a frame which is completely enclosed for protection, upon which are flat cams that operate crossheads by means of contact with rollers that operate the various levers through reach rods. This makes it possible for one man to operate as many as six machines. The machine can be started, reversed and stopped, the back gear thrown in and out, the turret indexed, and the cut-off and forming tools operated as often as desired.



**A bumper after being tested with a four-mile-per-hour blow**

The attachment of the "iron man" to a screw machine does not call for any alterations and in no way affects the availability of the machine for use without the automatic attachment.

# Making Sport a Science

## Devices and Tests Which Determine the Individual Fitness of Candidates

*By Dr. Alfred Gradenwitz*
Berlin Correspondent, SCIENTIFIC AMERICAN

WHILE sport in the curriculum of pre-war German public schools played only an unimportant part and was practically excluded from the university college, there has lately appeared among schoolboys and undergraduates a remarkable revival of sporting activities; and, inasmuch as everything in the Fatherland is done with commendable thoroughness, sport, formerly looked upon as a rival of scientific pursuits, has lately been promoted to the rank and dignity of a science. In fact, Berlin at present boasts two colleges of sport where everything pertaining to gymnastic exercises and outdoor games, as well as the behavior of the human body under the most varied conditions of physical activity, is investigated, practiced and taught in the same scientific spirit that is so characteristic of higher education at the university.

One of the most important tasks to be solved in this connection is the ascertaining of individual fitness for each kind of sport and the possibilities of the human organism with regard to the developing of this fitness. One of the pioneers in the field of practical psychology, Dr. R. W. Schulte, has installed at the College of Sport in Berlin a special testing laboratory for investigations of this sort entrusted to his care. His laboratory comprises a number of his own special apparatus for this purpose.

**The football candidate's test. Two hinged doors are placed in front of the ball about to be kicked. After the ball is kicked, the angles of both doors are examined to determine if they are equal or, if not, how nearly accurate the kick was as regards direction**

While the medical adviser specializing in sporting problems is mainly engaged in an investigation of the vestigated in the case of the footballer. Other tests of a purely mental character comprise the testing of the keenness of observation as well as the special type of attention and concentration power required in sports, not only for the sake of the sportsman but for umpire as well. The ascertaining of the individual type of memory and association of ideas is of especial interest, the sportsman's intelligence often being of paramount importance to his individual fitness. Judgment and discrimination, power of rapid combination and presence of mind, an increased adaptability and real ingenuity are among the qualities primarily required in the efficient sportsman.

However, psychic investigation at Dr. Schulte's laboratory is more searching still and even comprises an examination of feelings and individual temperament, the intensity and behavior of emotions, personal assurance and independence of outward influences, all of which are by no means neglected by the psychological experimenter wishing to get an idea of the would-be sportsman's fitness. Ambition, emulation, subordination and other psychic characteristics are bound to prove of considerable importance in choosing a given

*Left:* **The boxer's test, which consists of hitting the buffer plate with a series of even blows, the force of each blow being observed and recorded to determine evenness and control.** *Right:* **Determining the sense of rhythm of an oarsman. The observer sets up a given rhythm by means of a telegraph key, while the oarsman endeavors to follow that rhythm as nearly as possible. A recording apparatus keeps track of the observer's rhythm and that of the oarsman**

**Apparatus for testing courage or plain "grit" by means of a sudden dose of hot water**

structure, growth and functioning of the organs, the practical psychologist has a still more fascinating, though incomparably more difficult, task to grapple with, viz., the searching of the sportsman's psychic behavior. The psychological diagnosis tries to ascertain, gage and appreciate the various composite psychic characters and capacities, while practical psychotherapy investigates the laws according to which existing capacities are practiced, developed, trained and integrally utilized.

The rule of the selection of the fit applies most strikingly to sporting activities, though there is a natural spontaneous elimination of those unfit for a given sport. In fact, the beginner in the field can from the outset be shown the proper way and thus be saved a useless waste of energy and enthusiasm. After investigating, in the case of highly gifted masters, the capacities required, for example, in football or in boxing or in javelin throwing, the sportsman-candidate's individual fitness and faculties are checked up with the requirements thus ascertained.

The various factors tested at Dr. Schulte's laboratory form a list too long to be enumerated. Some of the more important are an examination of the acuteness of vision and sense of proportion, the gauging of distances, the muscular sense and sense of strength in the case of the boxer, the fencer's hitting capacity, speed gaging in the case of the tennis player, calmness and security in that of the gymnast, the sense of rhythm and cadence in the oarsman, the gaging of combination in branch of sporting activities. Extremely interesting and striking results are finally obtained by studying the individual's will power; the speed of decision, security of action, continuity of response and coordination of limbs should all be tested more or less in detail. Nor has Dr. Schulte been afraid of tackling such a complicated problem as a study of the power of decision in critical and dangerous situations, personal courage and energy, psychical capacity, skill and speed of motion, resistance to fatigue, and training capacity, in their most varied forms.

As one of the typical instances of the highly varied activities of Dr. Schulte's laboratory of sports, there is the football candidate test. The football testing device allows of investigating an important quality required in the practice of the football sport, namely, hitting capacity and the sensitiveness of joints. The candidate is asked to kick the ball lying in front of him in a given, exactly-prescribed direction, any deviation from which is ascertained by the ball forcing apart two side members suitably hinged. When the ball passes straight through these side members or doors, both of them are pushed aside to form the same angle, any difference ascertained between the two pointers enabling the error to be gaged. A third flap provided at the top enables any jerk pointing upwards to be ascertained.

Another apparatus is intended to gage the intensities of jerks in boxing. The candidate is asked to perform against the buffer plate of the apparatus, driving a

(*Continued on page 445*)

## A Milling-Machine Dynamometer

VARIOUS devices have been designed from time to time for determining the pressures exerted by a milling cutter on the various working parts of a milling machine, but up to the present time there has been no mechanism which could be relied upon to give accurate readings of these pressures; so that the designer of the milling machines as well as the designer of fixtures and milling cutters for use on them, have been very much in the dark. It has long been recognized that accurate knowledge in this regard would also be of material assistance to the designer of machine parts which are to be milled, because in the final analysis, the pressure of the cutter is first exerted on the piece itself and merely transmitted from it, first to the fixture and then to the milling machine.

Another element on which there is practically no existing knowledge is the difference in pressures exerted by cutters of different form or different design when taking duplicate cuts. It is true that a carefully calibrated machine, equipped with a direct-connected motor drive and ammeter, provides the means of determining the difference in horsepower consumed by various cutters, but means have been entirely lacking for separating the vertical thrust, the horizontal thrust, and the longitudinal thrust, and thus determining the specific pressures exerted in these three directions.

Also, with different combinations of feeds and speeds, the efficiency of the milling machine varies and it is therefore important to have means of determining the actual cutter pressures, entirely independent of the efficiency of the machine or any part of its mechanism.

In order to attain this object, the dynamometer shown in the accompanying illustrations was devised. This dynamometer provides means for reading the pressures exerted on any milling cutter while at work, in two directions, the readings being taken direct from the dials shown. The apparatus consists of a working table which is supported by a base plate, which is in turn bolted to the table of the machine. The vertical downward or upward pressure of the cutter is read direct from the left-hand dial. The longitudinal pressure of the cutter is read direct from the right-hand dial. These are the pressures with which the designers and users of milling machines, as well as milling cutters, are most concerned. However, if it is desired also to obtain the crosswise pressure, that is, the pressure in line with the milling-machine arbor, as, for example, if it is desired to determine the end thrust pressure, of a spiral milling cutter or a face milling cutter, the dynamometer can be mounted crosswise on the table, and the pressure in question read from the right-hand dial.

The work platen of the dynamometer is supported at each end by a wide plate fulcrum, their lower ends resting on two levers which carry a definite portion of the vertical load on the platen to a hydraulic chamber placed centrally under the work table. This chamber is connected with the left-hand gage which is graduated by trial in terms of the vertical load in pounds.

The horizontal load is transmitted through bars which are flexible vertically, to the crosshead seen at the right in our larger photograph, and this crosshead transmits the load to the hydraulic chamber seen between this crosshead and the end of the main frame of the dynamometer. This chamber is connected to the right-hand gage by the pipe shown.

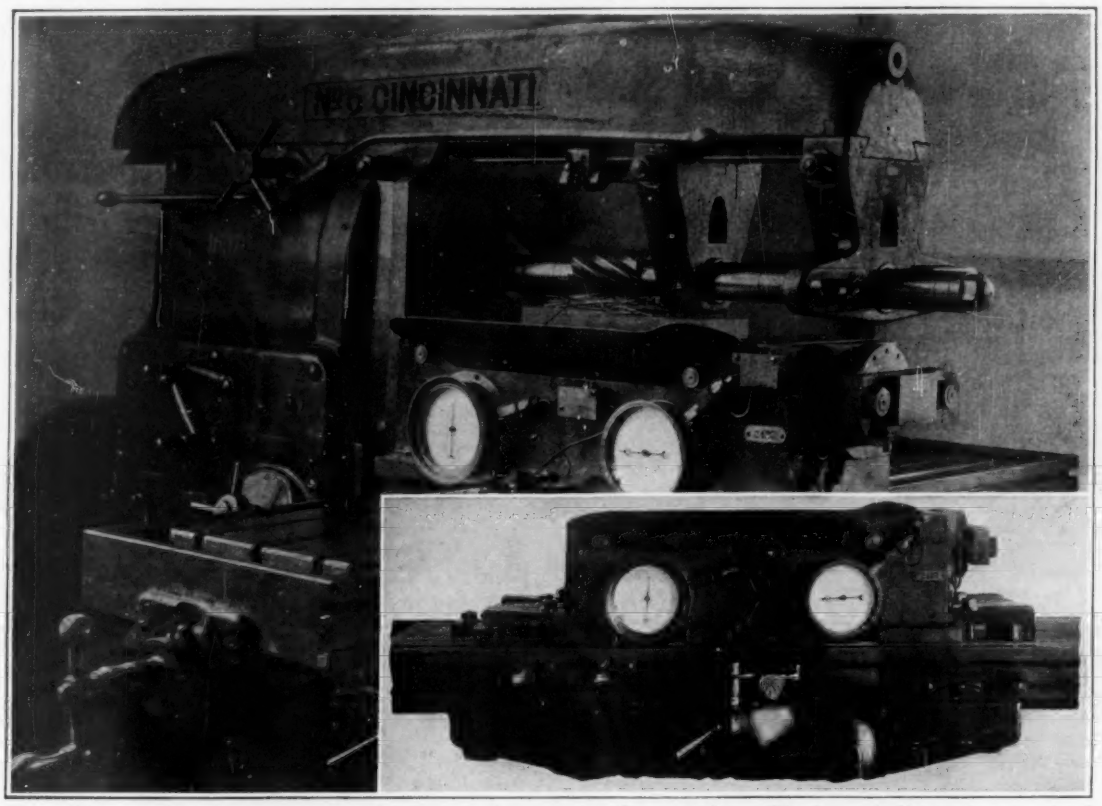
The plate fulcrums carrying the loads to the levers are so constructed as to be rigid against vertical and cross loads, but flexible to longitudinal loads, and the bars to the crossheads are flexible to vertical loads so neither system interferes with the action of the other.

Heavy springs are used to put initial loads on each chamber so they will show loads in either direction. Guards are provided so that any desired lubrication or flooding of the cutter may be used.

The dynamometer has the capacity to withstand loads of 25,000 pounds longitudinal, and also loads of 4000 pounds in the opposite direction, vertical downward pressures of 10,000 pounds and upward pressures of 7000 pounds.

The working surface of the working table is 16 inches long by 10 inches wide, and is provided with three T-slots. The height of the working table above the bottom of the base is 8 inches. The total size of the base of the dynamometer is 35 inches long by 14 inches wide.

It is obvious that the dynamometer is extremely valuable for manufacturers of both milling machines and milling cutters, as well as for shops where milling operations are studied and given proper attention (as automobile plants and experimental shops), for laboratories and shops of technical schools and colleges, etc. Problems attending standardization of machines and cutters can be more readily solved with its aid.




**The milling-machine dynamometer, as it appears when mounted for a reading. The insert indicates how much of the upper picture comprises the dynamometer itself**

This instrument has proven extremely satisfactory and very sensitive under tests. Quite obviously its use is not confined entirely to milling machines, but it is equally adaptable for making tests on planers, shapers, and with slight variations, drill presses.

## Identifying Animals by Imprints

IN *Discovery* (British) for May, 1923, Mr. C. A. Mitchell says: "The most recent development of the use of imprints from the ridges of the skin has been its extension to the identification of cows. It has long been known that the patterns on the fingers of lemurs and the higher apes may be as complex in their character as the human skin patterns, whereas the patterns of the ridges upon the friction skin of the lower monkeys are much simpler in character. In the case of a ruminant animal, such as the cow, it would be useless to look for any characteristic patterns in the hoofs, but, acting on a suggestion sent to me from America, I have made a number of prints of cows' noses, and have found that the arrangement of the sweat pores follows distinctive patterns, which can therefore be used for the identification of these animals. The practical value of this discovery lies in the fact that it is not an uncommon practice for one cow to be substituted for another and more valuable one after the purchase has been completed. A registration of the nose-prints of all pedigree animals would therefore prove an effective safeguard against this fraud."

The author is carrying out a further series of experiments to determine whether the patterns are permanent and remain constant in their form over a long period in the growth of the animal, and whether the differences are always as pronounced as in the case of these two animals.

It is quite possible that the same method of identification could also be applied to dogs, and, if so, it would be a very simple method of establishing their pedigree.

## Trees and Climate

IN every country a subterranean reservoir exists at a greater or less depth below the surface. It is the level of saturation which, of course, varies from time to time according to the rainfall. At the sea, it coincides with the mean tide level, but it rises more and more on going inland, and it is the level to which wells must be sunk before water appears in them. It is caused by the rain, which is usually said to run off to the extent of one-third; another third sinks in to form this reservoir, and the remainder is lost in evaporation. When following a river valley, one often notices a line of springs appearing at a certain level; this is when the valley has been cut down to below the subterranean reservoir, which then forms a wet trough for it to run in. When the reverse is the case, the river loses a great deal of its water by its percolating into the dry soil around and beneath it. In the East this last is very common, so that rivers very often get smaller and smaller the farther they go, till at last they dry up altogether.

We see now that the denudation of trees has cumulative ill effects which tend to reduce the fertility of the country. The reverse is also the case; a large growth of forests has accumulative good effects tending greatly to increase the humidity of the air, the equability of the temperature, and the fertility of the region. The moisture in the atmosphere, largely supplied by leaves, has a very great, but often unnoticed, effect on a climate. The aqueous vapor is impervious to heat rays, unless they come from a greatly heated source. In fact, it acts in much the same way as glass. The heat rays from the sun pass freely through, but when the same rays are reflected back from the earth, the glass or the water vapor acts as a screen to them. The atmosphere in this case is just a blanket like the roof of a greenhouse, with all the benefits which naturally accrue from it. This is the main reason why moist climates are so much more equable than dry ones. In a desert the day temperature often rises to 120 degrees or even 140 degrees Fahrenheit in the shade, while at night it may fall below the freezing point. In a moist climate in the same latitude the daily range will be perhaps from 80 to 85 degrees shade temperature in the day, and 65 to 70 degrees at night. The hotter the climate the more marked are these effects. In the moist climate of Bengal, in the forested parts, the thermometer scarcely ever reaches 90 degrees in the shade, whilst at night it is rarely below 80 degrees. In the same latitude in Bikaneer Desert or in the Sahara, the temperatures have a diurnal range of perhaps 70 degrees or 80 degrees instead of 10 degrees, and this is entirely due to the absence of moisture in the air. It follows, then, that the hotter the climate the more careful man should be to preserve his trees, but unfortunately exactly the reverse is usually the case, either from ignorance, want of fuel, or shortness of pasture.—*Abstract from article by Col. H. de H. Haig in Discovery (British) for May, 1923.*

# The Carlsbad Cave

## Recently Explored Cave in New Mexico Which Rivals, If Not Excels, Mammoth Cave of Kentucky

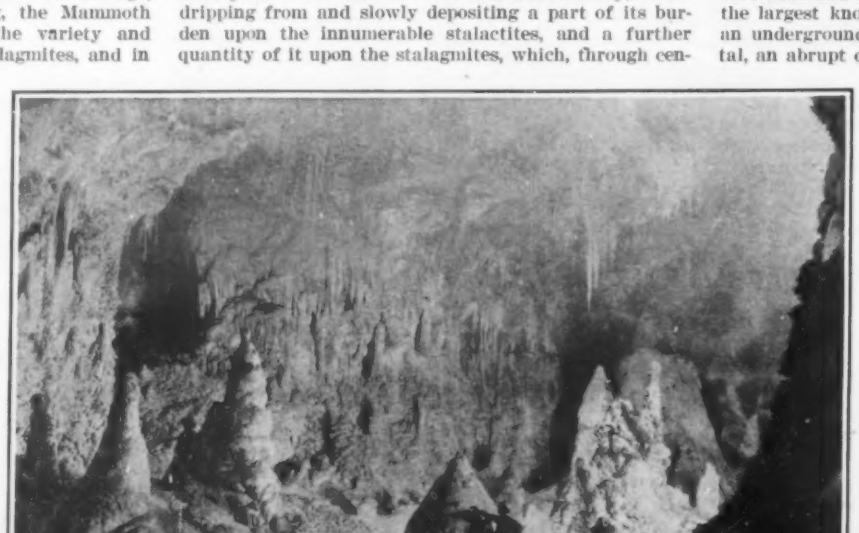
*By F. Le Roi Thurmond*

IN THE Guadalupe Mountains of New Mexico, twenty-four miles from Carlsbad and ten miles from the Texas line, there is a cave in limestone of Carboniferous Age, rivaling, if not excelling, the Mammoth Cave of Kentucky in the variety and unique forms of its stalactites and stalagmites, and in the great dimensions of some of its chambers.

The cave in question is little known, never having been fully nor officially explored, nor even exploited as a natural wonder. Its chief interest has been that it contained quantities of guano from the excrement of bats, valuable as a fertilizer because of the phosphoric acid and nitrogen it contains.

The "Bat Cave," as it is known locally, was discovered in 1901 by J. L. White and Bige Long, who were hunting deer when they observed a great swarm of bats coming out of a hole in the bed of a shallow ravine. Descending by means of ropes, they found a gallery running for miles to the westward, and about two hundred feet deep, where the descent was made. The floor was covered with blocks of limestone which had sloughed from the ceiling. Myriads of bats clung to the walls and ceiling, where they hibernated during the winter months, emerging only on summer evenings to feed on flying insects.

The cave was shortly afterwards exploited for the guano, the product being shipped to California, where it was manufactured into fertilizer, or applied in the natural state to the soil of orange and other fruit lands.



One of the many caverns of the Carlsbad Cave, located near Carlsbad, N. M., showing the beautiful stalactites and stalagmites

The writer, in company with Mr. White, one of the discoverers, recently visited the cave and spent seven hours underground. This time, however, was sufficient to visit only about a quarter of the known parts of the cave.

The cave is entered by means of a bucket attached to a cable and operated by a hoisting engine. The descent is 180 feet. The part of the cave near the entrances—there are three of them in a half mile—is the oldest in point of development and decay, because, being close to the surface, the rock above is not thick enough to retain sufficient water continuously to cause the steady drip into the caverns below, but fragments of broken columns in the debris underfoot indicated that these chambers were once adorned with many large stalactites and stalagmites before erosion had removed the great thickness of limestone above, and earth movements had shaken them down with the masses of limestone which covered the floor to an unknown depth.

Traveling westward through a series of chambers which widen and narrow, sometimes climbing or descending steeply for several hundred feet, we reached an estimated depth of 750 feet, about one and three-quarter miles from the portal.

Here were a number of chambers known as "The King's Palace." Surely it was a palace fit to house a king of the underworld! In one of these crystal-laced chambers one might discover a sleeping princess ensconced upon a jeweled couch. Other chambers of greater size might have been plutonic council halls, grotesque thrones surrounded and canopied with crystal forms as curious and weird as ever conceived by poet or drunken brain. The imagination, unlabored, might discover gnomes and trolls and all the queer little people who live in the sublight of poetic fancy.

Here was a study in the action of ground water in dissolving the calcium carbonate of the limestone and redepositing it in these grotesque and beautiful forms. This part of the cave is alive and active today, water dripping from and slowly depositing a part of its burden upon the innumerable stalactites, and a further quantity of it upon the stalagmites, which, through centuries of centuries, grow toward each other until they meet and coalesce in columns of exquisite form and marvelous beauty. Numerous factors are involved in creating the varied forms; stalactites—slender, cylindrical and fragile, or conical, massive or finely tapered; stalagmites like the petrified stumps of trees, or domes, minarets and spires.

Another view in the Carlsbad Cave. One room alone in this cave is estimated to be one mile long and one-quarter mile wide with ceiling 100 to 300 feet high

A fascinating aspect of the pendent forms is the wonderful musical notes given out when they are caused to vibrate. Striking lightly with a broken fragment will produce notes of marvelous purity, notes as delicate and sweet as those of a bird, or deep and sonorous like the pipes of an organ.

Lack of time prevented further exploration. However, according to Mr. White, there is a chamber some three-quarters of a mile to the westward, six hundred feet wide and five thousand feet long. This is probably the largest known chamber in any cave. There is also an underground stream and, seven miles from the portal, an abrupt cliff. Beyond this, nothing is known. As far as the actual dimensions of the various chambers are concerned, present figures are little more than more or less careful guesses.

"How was this cave formed?" a member of the party asked.

"Do you see that rusty streak in the roof where it is low enough to be illuminated by the torches?" replied the geologist. "There is your answer. That streak is the line of a fault. Water charged with carbon dioxide has moved downward and along the plane of the fault, dissolving and carrying the calcium carbonate of the limestone with it.

"'And did you notice before we entered that the portal was in the bed of a ravine or draw? That ravine is the surface expression of the fault, and, after having been formed by erosion, it facilitated the formation of the cave by capturing the surface water, where it flowed parallel to and directly over the fault."

The importance of this cave as a natural curiosity has been discovered by the Department of the Interior, which is now engaged in surveying and mapping, with a view to creating it and an adjacent area a National Park for the enjoyment of the whole people.

## Edison's First Incandescent Light

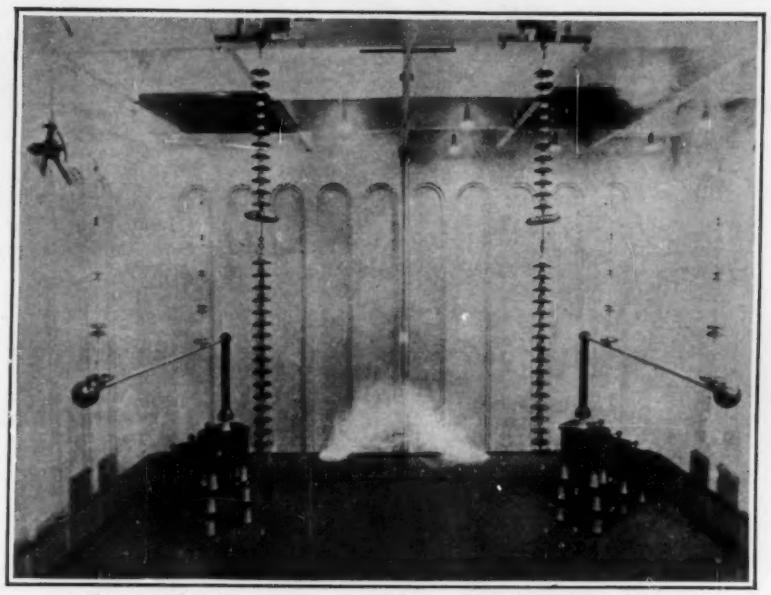
AT the present time, according to a "History of the Electric Light" issued by the Smithsonian Institution, there are 350,000,000 incandescent lamps in use in the United States and about an equal number in use in foreign countries.

When Edison first began the study of the incandescent light in 1879, there were several commercially established arc light systems in use in the United States. All these systems operated on the "series" system, the only system for distributing electricity known at that time. In this system current generated in the dynamo armature flowed through the field coils, out to one lamp after another over a wire, and then back to the dynamo. There were no means by which one lamp could be turned on or off without doing the same with all the others on the circuit. Edison realized that while this was satisfactory for street lighting, where arcs were generally used, it never would be commercial for household lighting. He therefore decided that a practical electric lighting system must be patterned after gas lighting, with which it would compete. He therefore made an intensive study of gas distribution and reasoned that a constant pressure system could be made similar to that of gas. The first problem was therefore to design a dynamo that would give a constant pressure instead of constant current.

After many experiments, Edison was successful, and in 1879 he made a dynamo which met every requirement and, in the same year, a carbon lamp in which the filament consisted of a carbonized piece of ordinary thread. On October 21, 1879, current was turned into the lamp and it lasted forty-five hours before it failed. A patent was applied for on November 4th of that year and granted January 27, 1880. All incandescent lamps today embody the original features.

## Tested for a Million Volts

ELECTRICAL testing on a huge scale is provided for in the factory at Freiburg, Saxony, where porcelain insulators for the continental market are produced. A gigantic experimenting stage has been erected, specially designed for the testing of the porcelains under voltages of a million or more. An idea of the size of this testing-stage, as well as some notion of the magnitude of electric discharges at this high potential, may be got by looking for the man in our photograph.

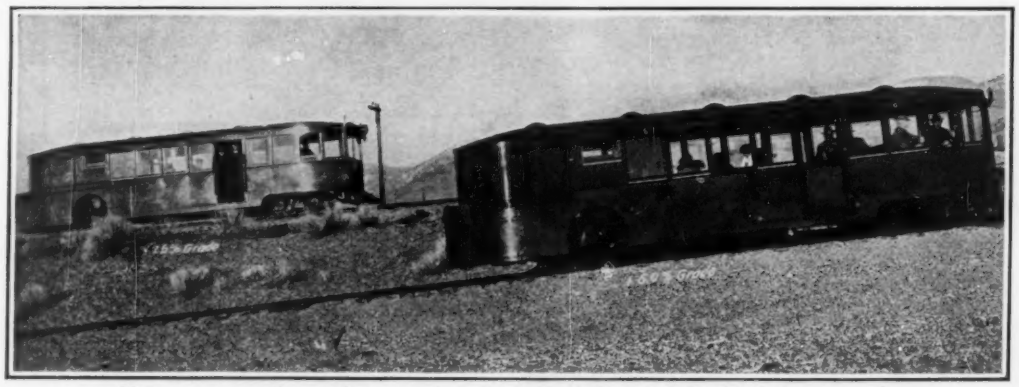


German plant for testing porcelain insulators at high voltages

## A Gasoline Rail-Car of Power and Stability

MORE difficult than the problems presented to most gasoline rail-cars are the operating conditions on the Nevada, California and Oregon Railway. The track is of the narrow gage of three feet, which would make it seem almost inevitable that stability would suffer to some degree. The altitude ranges from 4500 to 5500 feet above sea level, at which the air is appreciably leaner in oxygen than in most places where automobiles do heavy duty. But the vehicles illustrated herewith have been conspicuously successful under these conditions. On the fastest trip recorded, a 100-mile stretch was made at an average speed of 35 miles per hour, negotiating grades as steep as 2½ per cent, with 28 passengers. Speeds as high as 55 miles per hour have been attained. On the initial run of 520 miles the gasoline cars average 11 miles per gallon, and refilling the radiator and crankcase called for the addition of only one quart of water and one pint of oil.

These cars are 32 feet long, over all, and eight feet high from rails to roof. They are operated, like any well conducted automobile, by a single man, from the front end. They carry four-cylinder motors, 4½-inch bore and six-inch stroke. The motor is placed behind the rear axle, eliminating all revolving parts in front of that point, and enabling the car to be hung very low—14 inches from top of rails to floor of car. Also, the noise and dirt of the motor are left behind on the right of way to a very large extent through this construction. The car weight is 16,000 pounds. The cars are built by a commercial concern, and are available in even narrower gages than the one used on this line. In all sections of the country, the railroads are turning to the gasoline car as a means of meeting the problems of the short line and the line on which traffic is not heavy enough to support the conventional steam train. Gasoline-car manufacture will doubtless become a growing specialty in the presence of this newly created demand.



Narrow-gage rail-car whose gasoline-driven motor is located behind the rear axle

## To Prevent Lamp Thefts

RAILROAD companies and other large users of electric light bulbs are up against the problem of preventing the bulbs from being carried off surreptitiously by persons who prefer to get their bulbs for home use in this way rather than pay for them. A writer in the *Electric Railway Journal* of June 15th, discusses the several possible plans which have been tried to discourage the practice.

The simplest of these, although probably the least effective, is to mark the lamps in such a way that they are easily identified.

Another plan is to use a base that will not fit a standard fixture. A third expedient is the employment of a lock socket. Lastly, it is possible to use a lamp of unusual voltage, which will thus be too high or too low for common use; hence there will be no temptation to steal it.

One variation of the "different-socket" plan is to employ a socket with a left-hand thread. Incidentally, this is the method used by the New York City Interborough Rapid Transit R. R. to prevent the 40-volt emergency lamps from being used in place of the regular 130-volt bulbs; the former, having left-hand threads, will not fit any socket except those especially intended for them. Another variation of this idea is the use of a lamp with a bayonet base, as sockets to fit such bases are practically unavailable to the general public.

However, probably the most effective and most practical plan so far tried has been that of the lock socket. The lock socket is difficult (although not impossible) to remove without the key. Moreover, the very fact that it is locked acts as a deterrent.

One form has a "dog" which is pivoted so as to permit the lamp to be inserted without difficulty, but which "bites" when an attempt is made to unscrew the bulb. It is easily unlocked, however, with the proper key.

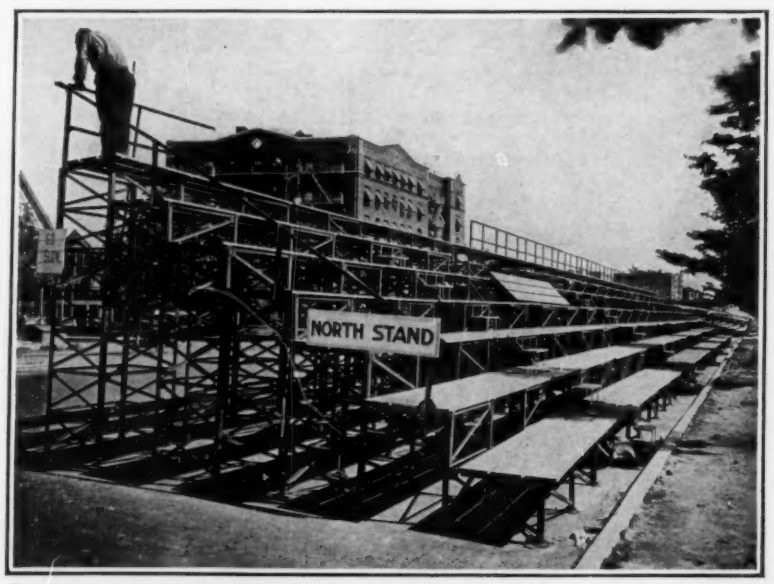
The Brooklyn Rapid Transit Co. has adopted a form of lock socket which has an interior shell that turns freely within the outer casing; consequently the lamp cannot be unscrewed until the key is inserted to engage the slotted base and thus prevent rotation. As the socket simply turns, the thief is not tempted to apply brute force to the lamp.

## Better "Gas"

A SURVEY just made by the Bureau of Mines shows that there has been an upward trend in the quality of gasoline sold at the curb in several well distributed cities of the United States. The "gas" vaporizes easier. This is the quality the motorist most wants, especially in cool weather when the rhythmic rasping of the self-starter is so persistently heard. Contrary to general belief, however, there is little difference in actual power value between the low and high volatile gasolines, and this difference favors the low volatile fuel. When one descends along the scale to kerosene the fuel value is higher than gasoline. However in common practice the gas of high volatility is more eagerly sought than the low, both for the reason that it enables easier starting, and because in the average motor it is vaporized better and the motor has a harder "kick." After all, it is not the theory but the kick of it that we want.

## High-Altitude Tests Without Leaving the Ground

OUR cover this month shows the testing chamber for prospective aviators now in use at the French experiment station at Bourget. This chamber is intended to show what will happen to the candidate's respiration and to all his other anatomical functions at high altitudes. The atmosphere in the chamber is exhausted to a point corresponding with the altitude for which the test is to be made. Every provision is made for effective use of the apparatus. Thus, while there is naturally no escape for the unhappy candidate until the test is completed, it is recognized that the examining doctor himself may be less efficient under high-altitude conditions than normally. The matter of pressure is perhaps not so serious under this head, but that of oxygen is; so the doctor wears an oxygen mask that insures his normal respiration. All the controls for the apparatus are in duplicate, one set being inside the test chamber and one outside, so that the entire operation of the test may be regulated from within or from without.




Better type of portable grandstand, developed by New York's municipal engineers

## Portable Grandstand of Structural Steel

A NEW portable grandstand has recently been developed by the Department of Plants and Structures of New York City. The framework of the stand is built of structural steel units 5 feet long and 1 foot 5 inches high. The units are assembled to form the risers of the stand. Car bolts are used to fasten the sections together. Longitudinal sway braces of 1¼ inches by 1¼ inches by 1¼ inches angle iron are bolted in between opposite panels of adjoining risers as the stand is erected. The risers are spaced 5 feet apart. The flooring of the stand is made up in sections 1 foot 8 inches wide and 10 feet long, secured to the risers by clips which extend under the flange of the top angles of the riser frames. The seats are supported on pipe pedestals bolted to the floor sections.

The method of construction eliminates a great deal of the liability of the stands to collapse, and provides clean seats separate from the platform. Erection and demolition are very much more expeditious than with the more familiar type of portable stand.

# The "Horse-Hair Snake"

## An Account of the Extraordinary Life History of One of Our Common Worms

*By Leon Augustus Hausman, Ph.D*
Assistant Professor of Zoology, Rutgers College

WITH the inquiries of modern biological science into the life-history of the "horse-hair snake," another of those pleasing fancies of our childhood *i.e.*, that horse hairs placed in a tub of water would turn into snakes, is forced to take its place in the realm of the fabulous. In this instance, however, science supplies us with a story concerning the life of the horse-hair snake far more extraordinary than that of which her researches have deprived us.

The belief in the transmutation of inanimate objects into animate beings is as old as the human race. The belief in the transmutation of horse hairs into snakes is perhaps the last to lose its hold. We find mention of the horse-hair snake in Shakespeare's "Antony and Cleopatra," Act 1, Scene 2:

"Much is breeding,
Which like the courser's hair, hath yet but life
And not a serpent's poison."

Sir Thomas Browne (1605-1682) in his celebrated "Pseudodoxia Epidemica," or Vulgar Errors, of his time, does not list this notion as erroneous, and since we may not suppose that so scholarly and singularly acute a collector of contemporaneous superstitions and legends was ignorant of the belief in this transmutation, we may infer that he also gave it acceptance. In view of the surprisingly intricate life history of the horse-hair snake it is not surprising that the belief in its miraculous metamorphosis from a horse hair has lasted well down into the twentieth century, and still persists in remote rural districts, and among children, to the present day.

The hair snakes, or hair worms, as they should be more properly termed, belong to the Family *Gordiidae*, and the Genus *Gordius*, a group of animals placed very low down, in the ascending scale of animal life, or, to be precise, between the Flatworms (of which the liver-flukes and tape-worms are representatives) and the Starfishes, Sea-Urchins, etc. They are not, as formerly supposed, at all allied to the higher worm forms, such as the common earthworm. The hair worms resemble

**Fig. 2—Mass of Gordius twining together in a typical "Gordian Knot" amid water plants**

nothing so much as animated horse hairs (Fig. 2.) They are slender black, brownish or yellowish forms, from three inches to a foot in length, and slightly tapered at either end. Roadside ditches, pools, old watering troughs, and the shallow edges of small lakes and ponds are their favorite habitats (Fig. 1.) They seldom inhabit running streams. When active they are engaged, usually, in making their way slowly and apparently rather ineffectively through the water by a languid undulatory motion of the slender body, or writhing about among submerged vegetation. Frequently many individuals may be found intricately knotted and twisted together into a ball, sometimes to the number of a hundred or more, which, being reminiscent of the famous Gordian knot of Alexander the Great, has given the family its name. Great numbers of Gordian worms often appear suddenly in pools and ditches which, just before, were apparently free from them, and following such appearances tales have sprung up attributing their presence to a rain of worms.

The female *Gordius*, distinguished from the male by her acuminate, instead of bifurcated tail, after fertilization deposits her very minute eggs (which are sheathed in a long delicate gelatinous strand resembling a sewing thread) on the stems and leaves of submerged aquatic plants (Fig. 3.) Before fertilization both sexes are round, but become flattened after the loss of the genital products.

After about four weeks there develops from each egg a minute larva, about 1/450 of an inch in length and vastly unlike the parent, having a segmented body, and bearing on the head a formidable protrusible boring apparatus consisting of stiff chitinous rods. About the base of the boring proboscis is grouped a series of tubercles each bearing a decurved spine. This creature

**Fig. 6—Predaceous ground beetle (Harpalus), within whose body the Gordius young grows to maturity after leaving the Mayfly larva**

swims about actively in the water for a short time, and then bores its way into the soft parts of the body of some aquatic nymph (*i.e.*, young of an insect), very commonly selecting the nymph of some common Mayfly (Fig. 5.) Within the body of the young Mayfly the *Gordius* larva loses its boring proboscis and its tubercle-bearing spines; the posterior portion of the body elongates, and the creature grows into a young hair worm. At this stage it leaves the body of its first host, in a rather dramatic manner, and takes up its existence in the body of its second host. This second host is often the common *Harpalus* beetle (Fig. 6), and the transferrence of hosts comes about as the result of the devouring of the first host by the second! Within the body tissues of the *Harpalus* beetle the young hair worm completes its growth, and later emerges and escapes into the water in the form in which we are accustomed to see it.

There are many vicissitudes in the life of the hair worm. Upon the emergence of the larva from the egg it must first escape the devouring maws of numerous fishes, and the gullets of a vast host of lower forms of aquatic life. Its first host, the Mayfly or other nymph, must then be stranded upon dry land (commonly by the drying up of the pool), and next must fall a prey to a hungry *Harpalus* beetle. The hair worm must, in its transition from Mayfly to beetle, evade the cutting mandible of the latter, and be lodged unbitten, within its stomach. Upon arriving at maturity within the body tissues of the beetle, the hair worm

**Fig. 1—Roadside ditches, a typical Gordius habitat**

must trust to luck, of a seemingly most capricious sort, to be carried into the immediate vicinity of water. Without the close proximity of water, upon its emergence from the *Harpalus*, it would die at once. Only those worms whose hosts fall into the water or are carried away by floods, probably ever arrive at full maturity.

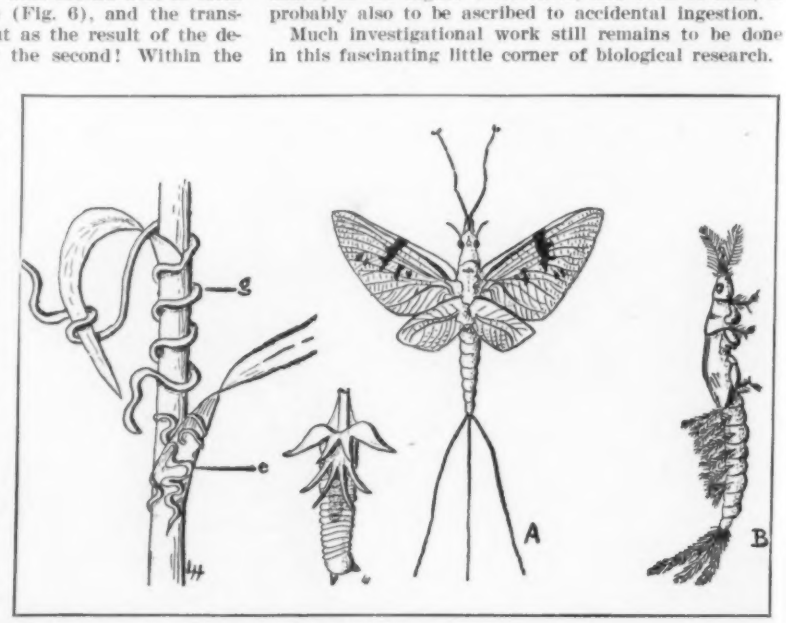
It will be seen that the chances of the particular sequence of circumstances favoring the growth of any individual larva into a mature hair worm must be very meager indeed, and only a very minute proportion of hair worm larvae probably ever complete their life cycle. Indeed, if we contemplate the dangers of destruction which the hair worm must avoid on its journey from youth to maturity it seems truly miraculous that any should be able to make the journey, and reach the goal of all life, the period of sexual maturity and reproduction.

Only the most important of the dangers of destruction are here listed; there must be many more of which we have little knowledge. It may be because of the unusually large number of hazardous vicissitudes in the life of the hair worm that there has come about a very interesting and unusal functional adaptation of the genitalia, whereby the worms are able to reproduce themselves before they become fully adult in their other body structures. Another apparent provision which nature has made as a counterbalance to the great mortality of the hair worm, is the remarkable ability in egg production. It has been estimated that as many as six million eggs can be laid by a female in one season!

While the larvae feed upon the fatty portions of the bodies of their hosts, the adults take no food, and indeed, can take none, for the mouth is functionless and is stopped by a cuticular plug. Thus the adult life is merely a short period for mating and egg-laying, and the hair worm passes the greater part of its existence as an internal parasite. From one to five individuals have been found in some insects, and during the last stages of their existence as internal parasites the worms may be coiled up among the viscera of their hosts, and may even extend through the thorax and up into the head! The weight of the worms is often greater than the combined weight of all the internal organs of the host!

Hair worms have also been found in the bodies of crickets and grasshoppers, forms which feed upon vegetation. In such cases the hair worms may have become prematurely freed from the bodies of their hosts by the death and disintegration of the latter, and consumed with the foliage on which they may have fallen. The presence of hair worms, likewise, within the bodies of snails, of the higher vertebrates, and even of man, is probably also to be ascribed to accidental ingestion.

Much investigational work still remains to be done in this fascinating little corner of biological research.




**Figs. 3, 4, and 5—Female Gordius twining about the stem of a water plant and laying eggs. g: Gordius; e: eggs. The adult A and the young or nymph B of a common Mayfly. It is within the body of the latter that the free-swimming larva of Gordius passes the early stages of its life**

## Where Bridges Are Built in the Dead of Winter

THE Tanana River Bridge, recently completed as the last link in the Government's Alaska Railroad, is unique in several respects. Measuring 700 feet from pier to pier, it is the second longest single-span railroad bridge, being exceeded only by a similar bridge in St. Louis. Approximately fifty miles from Fairbanks, the "Golden Heart" of Alaska, it is the farthest north of big bridges. It was constructed in the dead of winter, with a temperature running for days at a time between 50 and 60 degrees below zero.

With its completion, the Alaska Railroad now operates on a standard-gage track from Seward, an all-year-open seaport, to Fairbanks on a two-day, all-daylight schedule. Before the bridge was completed, narrow-gage was used from the north bank of the Tanana river to Fairbanks, with standard-gage from Seward to the south bank of the river. Crossing of the river at Nenana was made in summer by two ferryboats, the "Midnight Sun" and the "Matanuska." In winter, when the ice in the river froze to a thickness of three to four feet, a narrow-gage track was laid on the ice and trains from the north side were brought across the river to meet the standard-gage trains on the south side. As the time for the spring breakup approached, the tracks were taken up and dog teams and sleds were used to transport freight and passengers over the crossing.

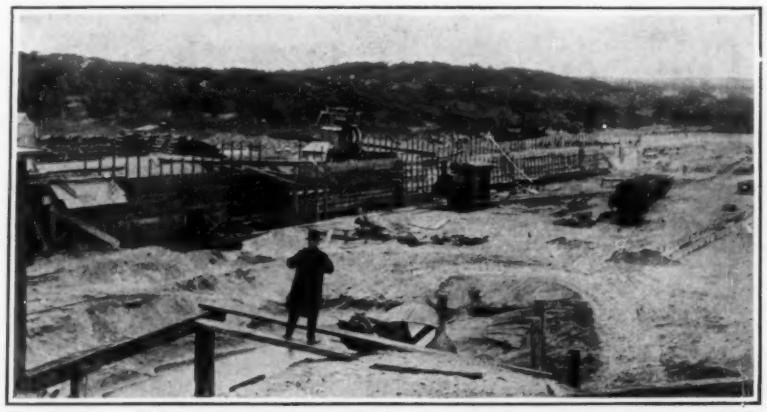
Erection of the main truss took place during the coldest weather in Alaska, when, for short periods of time, the temperature drops as low as 50 or 60 degrees below zero. As the ice goes out of the Tanana river not earlier than May 12th, if the bridge were built during the summer it would be some time in June before falsework could be established across the river, which would leave but a three months period before the "ice run" in the fall of the year. In addition, falsework would be endangered during the summer months should one of the big floods take place. These occur frequently, carrying driftwood as large as full-sized green cottonwood trees, with roots and branches intact, which have been swept away by the flood in the process of bank erosion. As the formation of solid ice usually is complete by the end of October and it remains in place until May, this six-month period was selected in which to erect the bridge and remove the falsework.

The bridge was built at a cost of $1,084,412.42, including the cost of changing the line of approach and transportation of material. This is approximately $200,000 less than the initial estimate. The total length end to end of steel is 1302 feet, and the total length from the south end of timber structure to the face of the parapet of the north abutment is 4183 feet. The bridge has a clearance of 47 feet above mean summer high water, which is ample for river steamers designed to proceed beyond Nenana to the upper river. The single span of 700 feet, crossing the river from shore to shore, makes the bridge oblivious to any ice movement in the spring breakups.

Nenana, the townsite at which the bridge is located, is a transfer point for shipments down the Tanana and Yukon rivers, and the Alaska Railroad has established a joint tariff on freight shipments from river points to Tacoma or Seattle. The first large shipment, consisting of several carloads of high grade lead-silver ore, was received at Nenana early in June.

Fairbanks, the interior terminus of the railroad and the center of lode and placer gold mining, is now in almost daily communication with the outside world. Prior to the advent of the railroad it had to depend on dog sleds in winter and the only less uncertain river boats in the summer.

The three-foot concrete footings on which rest the expansion seams



The bottom of the 14-foot diving pool, showing the flow of ground water which has to be taken care of

The Tanana River railroad bridge in Alaska, of a single span to make it safe from ice and freshets, and built during the winter while the river was heavily frozen over

## The Largest Swimming Pool for Ten Thousand Swimmers

THE largest swimming tank in the world has just been completed in San Francisco as an integral part of the great park and playground program planned for this city. It is of reinforced concrete, 1000 feet in length and 100 feet wide, except for a center portion which measures 150 feet across. Accommodating 10,000 swimmers, it cost approximately $80,000. The tank is located about three miles south of the Cliff House and about 150 yards from the ocean. The fact that ocean water is to be used in the pool, with its salt-water content, has necessitated many special features of construction.

Excavations for the tank were made entirely in sand. Eight-inch drain tiles were placed below the bottom of the tank for the purpose of taking care of the hydrostatic pressure. These tiles drain into three fresh-water wells, from which the water is pumped by electrically driven pumps and used for irrigating the municipal golf grounds about a mile and a half distant. The hydrostatic pressure is very great, as the level of the ground water is the same as that of the salt water in the pool. If provision had not been made for pumping this fresh water from under and around the pool, the concrete bottom would bulge upward when the pool was emptied.

The bottom of the tank is interlaced with expansion seams running longitudinally and transversely, the longitudinal seams being 42 feet apart. These expansion seams rest on five-inch reinforced concrete footings, three feet wide. This footing has been given sidewalk finish and painted with coal tar to permit a bond between the floor slab and footing, thereby making expansion possible without disruption of either floor slab or footing. The expansion joints are calked with one-inch spun oakum, and the remainder of the seam poured with plastic asphaltic cement. To the concrete mixture was added hydrated lime (equal to 5 per cent of the weight of the cement) as an integral waterproofing of the mass concrete.

The floor slab is five inches thick—4½ inches structurally and one-half inch cement finish on the inside. The cement finish was made by using a 1:2 mix Portland cement mortar, to which was added for each sack of cement five pounds of a waterproofing compound. The entire inner surface was finished with this mixture to overcome the chemical action of the salt water on the concrete and to give a smooth and even finish to the interior of the tank, thereby preventing possible growth of algae.

The walls are divided into 60-foot sections, at which points there are expansion joints, consisting of wedge-shaped joints, forming a key which interlocks the two wall sections. The seam is composed of five strips of expansion seams and two 4½-inch, 13-gage copper sheets, put in to eliminate any possible chance of the penetration of salt water from the pool into or through the concrete, and also to prevent ground water from entering into the concrete at the joints.

The swimming pool is filled with ocean water pumped by a 12-inch centrifugal pump with a capacity of 5,000 gallons of water per minute. The water is pumped through a 16-inch steel pipeline 750 feet in length, extending 200 feet beyond the zero tide level and resting on a concrete pier, thus assuring clean ocean water at all times. The tank is drained by gravity, the water passing out through the 16-inch steel pipe. However, five feet of the 14-foot diving pit will be drained by a special salt water pump (as the diving pit is below the level of the sea), thus making a total of six pumps that will be necessary to operate the pool. The swimming tank will hold 6,300,000 gallons of water.

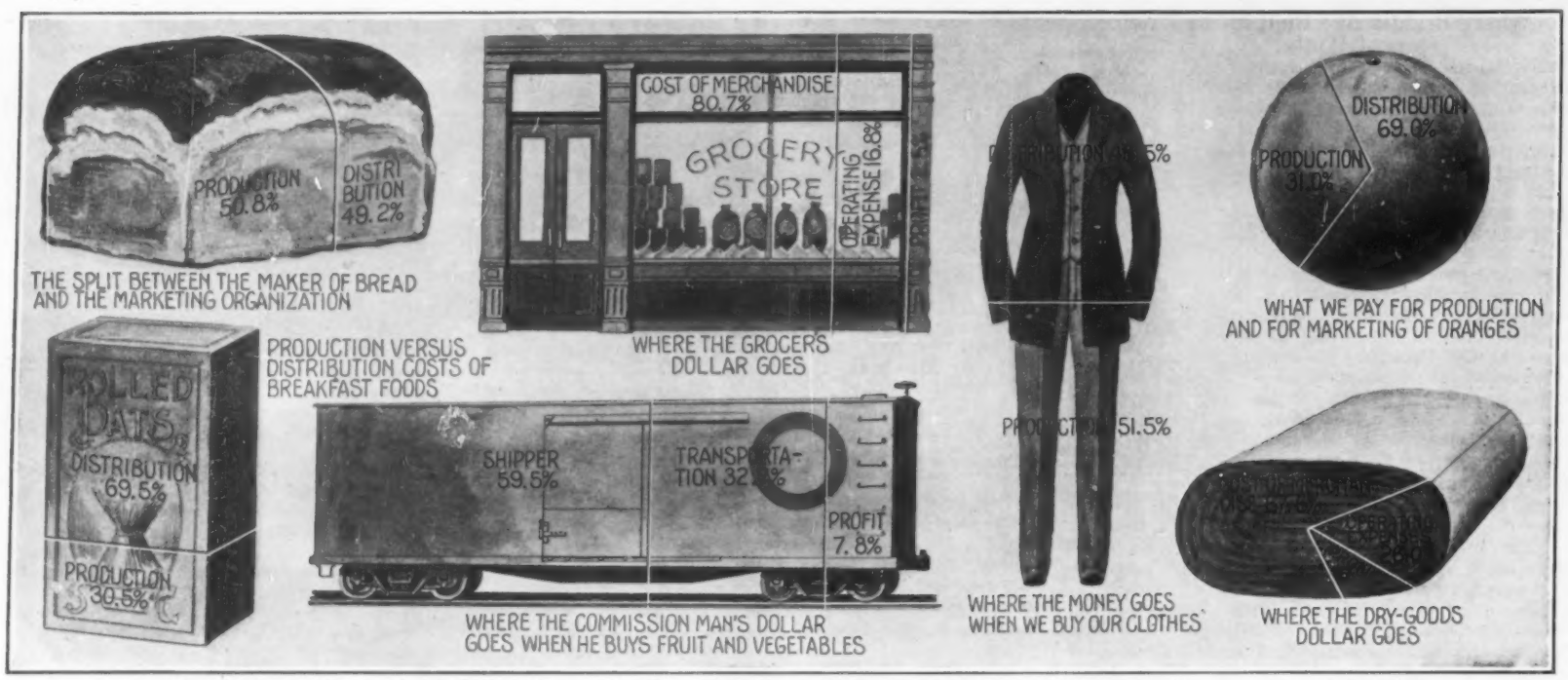
## Nature May Have Something Else Up Her Sleeve!

OIL wells, which, as all the world knows, produce crude oil—and some of them a very low grade of crude at that—can produce something else.

At least, one well can, and is doing it, steadily, day by day. That is a well located on Swaggart farm, a mile east of Deer Creek, Grant County, northern Oklahoma. This well is making about 1500 gallons of pure, high gravity gasoline, testing 70 gravity, every day, at 4000 feet. The owner of this well has taken the opportunity to tank the daily production and put it on the market at 10 cents a gallon. It is being sold to scores of Grant County truck and touring car owners, who formed a waiting list soon after the well started making gasoline.

Natural gasoline is not unknown to the oil industry—in fact, what is known as natural or casing-head gasoline is an important end of the oil business. However, in this case the gasoline flows from the well and is not recovered or collected from the gas flow, as is the case with ordinary casing-head gasoline.

Geologists differ as regards geological conditions responsible for the gasoline flow, except to declare that conditions underground must have been such as to perform in a certain manner the refining process which man ordinarily uses to extract gasoline from crude oil. At any rate, the well owner and the public which buys the gasoline have reduced the complicated oil business to a simple thing in this case, whereby the production, refining, transportation and marketing of gasoline are completed practically in one operation. No other wells of the Deer Creek field produce other than a fairly good quality of crude oil.




**Graphical display of the way in which the dollar with which certain commodities are bought is split between producer, carrier and distributor**

# The Science of Distribution

## An Authoritative Survey of the Devious Channels that Lead from Producer to Consumer

WHEN our grandfathers wore homespun clothes, raised most of the food they ate and chopped the wood for their home fires, the cost of distributing the essential commodities was practically nil. But:

"Cities grew and became the market places of agriculture. Inventive genius perfected machines to relieve more and more hand labor and to produce goods in greater volume. Working days became shorter and time and opportunity for recreation became greater. Education and travel created a desire for comfort, convenience and refinements not dreamed of in earlier generations. Invention after invention revolutionized habits and customs. Electricity added to the length of the day by lighting cities and providing means of rapid, comfortable locomotion. Telephone and telegraph extended communication and nationalized industry, commerce and finance.

"Refrigeration revolutionized the transportation and storage of food products and changed the living habits of the Nation. Fruits, vegetables and fresh meats were transported to distant markets, the production of the whole country was made available to the large consuming centers and crops of seasonal production were offered to consumers throughout the greater portion of the year. The consumer came to accept unusual service and convenience as a matter of course and finally to demand more. Each new service and convenience drew additional people into the activities of distribution. Time-saving, convenience, comfort and satisfaction became the determining factors in the excellency of service. More and more facilities were created, more and more people were engaged, with a constant upbuilding of expense, until *we now have reached a point where it costs more to distribute and serve than it costs to produce.*"

The above is not the work of an imaginative writer, but is quoted from the report of a Congressional commission. This "Joint Commission on Agricultural Inquiry" has just completed the most remarkable document of the kind ever compiled. Congress in the rôle of scientific investigator is at least something of a novelty. But this report assumes the dignity of Science; nothing less.

For the first time it lays before us accurate figures and facts on the cost of producing and distributing a great many of the commodities we have come to regard as essential. For the first time we are given a basis for sound judgment on such mooted questions as "the high cost of living" and "profiteering," and, as might be expected, the average conceptions on these questions are far from anything warranted by the facts. For the first time we are given definite conclusions on how conditions may be bettered—conclusions arrived at by the same methods used by the bridge builder for determining the structure of a truss or the size of the foundation.

This knowledge has been gained with the most painstaking care. When the committee was appointed, with Representative Sidney Anderson of Minnesota as chairman, it was instructed to investigate "the present condition of agriculture, the cause of the difference between the prices of agricultural products to the producer and the ultimate cost to the consumer, the comparative conditions of other industries and the prices of other products, and the marketing and transportation facilities of the country." Similar investigations have been ordered before; they have come rather to be expected as a graceful gesture on the part of Congress, even though they mean little or nothing. But this commission was nothing if not thorough.

The first difficulty encountered was the rather startling discovery that "there were practically no fundamental data of a government or public character with respect to marketing and distribution, and it was therefore necessary for the Commission to undertake a pioneering effort to secure from original sources the basic facts upon which a consideration of the problems of distribution might be predicated."

With a view of securing technical assistance and to secure the cooperation of the trades affected, the Commission set up in each trade or industry a committee whose function it was to assist the Commission in securing and correlating the information desired from the trades. For instance, the Commission set up a retail grocers' committee, a food manufacturers' committee and similar committees in the trades dealing in dry goods, clothing, shoes, hardware, meats, etc.

With the assistance of these committees, questionnaires were worked out, designing to reflect, over a period of years beginning with 1913 and ending with 1921, the actual price ranges of representative commodities distributed by these trades. These, as far as possible, reflected the portion of the consumer's dollar taken by each distributor, manufacturer or producer. In this way it was possible to check the figures submitted in the questionnaires of a given trade with the figures submitted by other factors in a chain of distribution and to obtain substantial accuracy in the figures obtained through the questionnaires. Fifteen thousand questionnaires were sent out and returned, covering a total of more than 200 commodities.

A single instance will illustrate the effort that went into the report. The committee on department stores, at its own expense, rented two floors of a New York skyscraper and installed there a large force of accountants and assistants, who worked steadily for some months assembling and condensing the facts about department stores. The final result was a table of figures, which occupies just one page of the voluminous report. And yet that table contains facts which never before were available, which were invaluable in reaching a final conclusion.

And what of the facts as finally adduced? Are they worth all of this trouble? Is there really anything wrong with our system of distribution? If so, what is it, and is there a remedy?

The facts show unquestionably what we have only surmised before: that in many details our system of distributing the common commodities of life is wrong. For instance, of each dollar spent for bread in the United States in 1921, only about fifty cents represents the actual cost of the bread, baked ready for your table. The other half of the ultimate cost represents what was spent on service, transportation and selling costs in getting the loaf from the bakery to your table.

Of each dollar you spent for rolled oats in 1921 only 30 cents went to the maker for his completed, boxed product. It took 70 cents to transport and sell the oats to you. A dollar's worth of oranges cost only 41 cents to produce and harvest ready for market. Of each dollar you spent for clothes, 31 cents went for the cost of distribution—the cost of selling the clothing to you. Of every dollar spent for shoes, 28 cents went for distribution.

The freight bill on a carload of cabbage shipped from Texas to the big Northern markets was about six times as much as the original value of the cabbage in Texas. Most of the fruits and vegetables from California, consumed in the East in such large quantities, incur freight bills as great as or greater than their first value. An investigation of 9476 representative carloads of fruits and vegetables sold at wholesale in Boston, Chicago, New York, Philadelphia, Pittsburgh and other large cities showed that about 60 per cent of the wholesale price was paid by the shipper for the commodity, that about 32 per cent went for freight charges, about 2 per cent for miscellaneous handling charges and about 2 per cent for profit.

Incidentally, the profiteering bugaboo which has been raised in the last few years has been roughly handled. In nearly every line examined there is a definite trend toward smaller and smaller profits. Indeed, during the period of highest prices, when the cry of profiteer was loudest, many industries sustained a loss. In 1913 the profit to the manufacturer on canned milk was about 12 per cent. In 1918 the profit was a fraction of 1 per cent; in 1920 the industry showed a loss of 3.15 per cent and the profits in 1921 were about 4 per cent. Most other commodities followed the same trend. Undoubtedly, in many cases, the charge of profiteering

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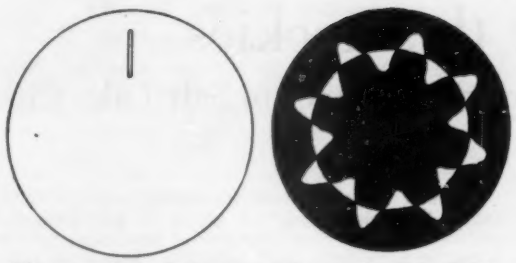


**The mounting of the neon tube on the disk (left), and the visible indication of the wave-form of the current supply that is secured on rotation**

## Recording Alternating Current Wave Forms

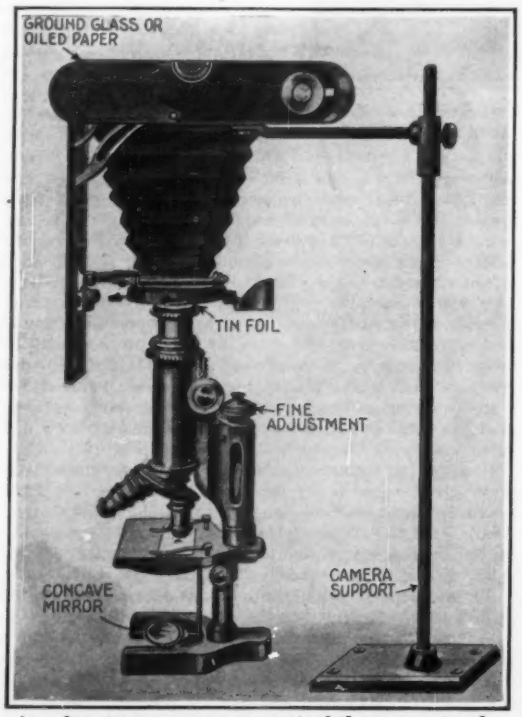
AS is well known, the recording of wave forms of alternating current supplies is in these days an important process to the electrical engineer. Various types of oscillographs have been devised and applied for the purpose, but all are relatively expensive and complex pieces of apparatus. On the occasion of a visit to the recently opened research laboratory at Wembley, England, a new and very simple apparatus for tracing wave forms was shown. The apparatus is based on the use of the new discharge lamps containing neon gas. Under certain circumstances when the electrodes are in the form of straight wires the length of the wire covered with luminous glow is proportional to the current passing. Hence at any instant the length of the glow in the tube is proportional to the voltage applied. Accordingly, if the tube is mounted radially on the circumference of a rapidly rotated disc one sees the wave form outlined as a patch of light, a series of images being formed round the edge of the disc. The accompanying diagrammatic sketch shows the position of the tube and the resultant effect on rotation.

## Amateur Photomicrography by Means of a Microscope and Hand Camera

PHOTOGRAPHY through the microscope is at present an art of the professional world only. It is seldom heard of among amateurs, and yet such photography is one of the best instances in which the ordinary camera can be employed in exceptional work. With a little care a stock camera and a microscope will give remarkable results, providing that sharply defined subjects are used.

The camera should be supported firmly, its lens resting on the eyepiece of the microscope, so that the film is parallel to the object to be photographed. It is well to wrap tinfoil about the connection of the lens and eyepiece to avoid possible interference by light.

Successful results were obtained from a standard make of camera which takes pictures three and one-half by four and one-half inches. It has an anastigmatic lens and an ordinary timer. The focal length of the lens is six and one-half inches. The microscope used had objectives of four and sixteen millimeters, and a 7.5 eyepiece, giving magnification between one hundred fifty and three hundred fifty diameters.




**An advantageous arrangement of the apparatus for amateur photomicrography**

Lighting is the most important consideration of actual picture taking. Experiments proved that the best pictures were produced by intense sunlight (more powerful than is comfortable for the eye) directed on the slide by the concave mirror of the microscope. Owing to the fact that the light rays are tempered by both the lenses of the camera and the microscope, the film is not as violently affected as might be supposed. The direct sunlight enables the operator to take snapshots instead of time exposures, thus eliminating failures due to vibration, movement of the camera or movement of living subjects such as animalcules and diatoms. Of course, opaque subjects require longer exposures and a light thrown on them from above, but for ordinary objects only one-tenth to one-twenty-fifth of a second exposure is required.

In focusing the camera a good plan is to remove the back of the instrument and insert a piece of ground glass or, lacking that, an oiled paper, where the film lies, as is done with a plate camera. The image will fall clearly on the ground glass if no bright light falls on it from above. Adjustment is easily made by setting the camera into rough focus. Sharp focus is then procurable by using the fine adjustment on the microscope and examining the image with a hand glass for detail. The best results were secured when the camera was set for fifty feet. The smaller the distance for which the camera is set, the larger the image will be.

The method of using ground glass is also of value in determining the amount of light necessary and the evenness of its distribution. The camera should not be stopped down at all—that is to say, the opening should be as wide as possible. On a standard instrument this will be stop 7.5.

By the process described we have obtained various pictures of zoological interest. One of a spider leg, for example, taken under low power, gives in clear detail the structure of the tarsus and one joint of the leg. The long spines surrounding the joint and lining the chitinous tarsus may be seen distinctly. The pair of toothed terminal claws and the hairs give an idea how the creature can walk on walls and ceilings with ease.

The simplicity and lack of expense attendant upon taking such pictures as these should recommend itself to the teachers and students of high schools. Series might be made for use in biology, chemistry and physics classes. Not only would the pictures be of great use for demonstration and lecture purposes, but the work of making a group of studies would afford an excellent experience for more advanced students as well.

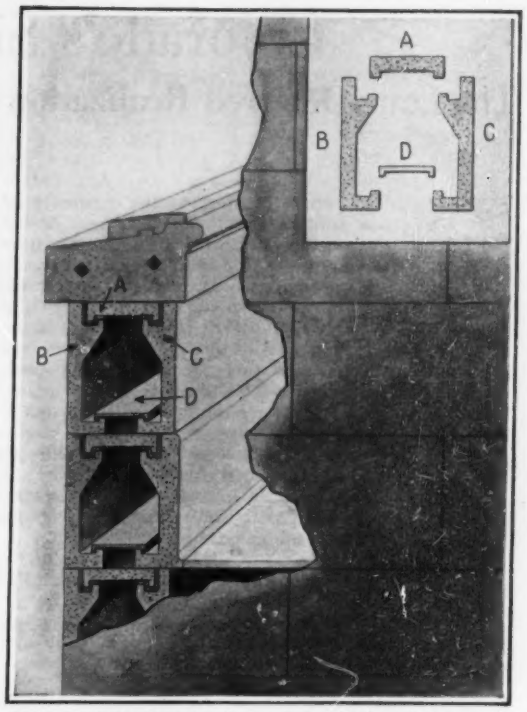
## Motor Vehicle Lighting

THE chief of the electrical division of the Bureau of Standards attended one session of the Society of Automotive Engineers at Spring Lake, N. J., on June 21, at which the problem of headlighting for motor vehicles was discussed. The preponderance of opinion was that so far as specifications or laboratory tests of headlight devices was concerned the present status is fairly satisfactory. It is, however, essential that more effective means be found to control the condition of headlights in actual use.

## The Negative Hole-Camera

A CURIOUS and interesting reversal of the usual photographic procedure and result is not as familiar as its simplicity would merit. In a dark-room, a lighted candle is placed upon a table; in front of this is held a cardboard with a small aperture; and in the shadow behind the board a sheet of clear white paper. Under this arrangement, one sees on the paper a reversed image of the flame. If the aperture is fitted up in one side of a box, it is possible to get, within, imperfect photographs of the objects outside the box.

So much is well known; indeed, the apparatus has a name—the hole camera. Recently, Prof. Hugo Oschatz, of Reuss, Germany, discovered that there is also a negative hole-camera. A candlelight in a dark room is used, as before, together with a white paper screen for final reception of the image. But, in place of the card with a hole in it, is used a plate of transparent glass with a small piece of paper pasted upon it, at the center, this paper being of size comparable with the hole in the card of the familiar arrangement. With this change, one sees on the white paper the dark image of the flame! The shape of the piece of paper is quite indifferent, just so it be small enough to give an image of the flame rather than of itself. Several pieces of paper may even be used, at different points on the glass, and then one obtains as many images of the flame, but gray rather than black, since all of them receive some direct light from the candle.



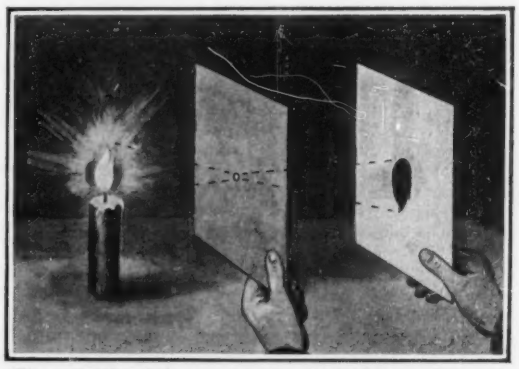

**Details of the latest scheme for reducing the cost of concrete construction. The four members A, B, C and D are precast in the factory and assembled on the job; and when concrete is poured into the space between them, a monolithic structure results**

## Concrete Shells for Concrete Buildings

BUILDING with concrete has become so stereotyped that little thought is given to it by the public, or even by those working in it. But the fact is, with forms for an ordinary dwelling house costing something like $3000 if made under the conventional system, a very considerable amount of inventive effort has been expended with the idea of cheapening this first cost of a concrete residence. Some of the answers which have been proposed to this problem have been such as to cheapen the house as well, which is not what is desired.

One promising line of attack, however, which is usually free from this objection is the building of concrete houses without the use of forms on the spot at all, through the use of pre-cast concrete blocks. The latest development of this idea takes the direction of a concrete tile unit, 5x8x12 inches, weighing eighteen pounds, easily handled and rapidly set. In structure it resembles the hollow clay tile. It is made with a wet mix, on an automatic machine for quantity production, at a minimum cost; and it is claimed that it can compete with all common building materials in its field.

Based upon the concrete tile is another and even more recent type of construction. In this the amount of factory work away from the site is minimized; the precasting is limited to the finishes for the inside and outside of the wall, together with caps for top and bottom, as illustrated at A, B, C, D in the accompanying drawing. These are set up rapidly on the job and the space betweeen them poured, making a monolith of the entire assembly. It is claimed that there is nothing that cannot be built in this manner, no matter how small or large, nor how high—whether wall, floor or roof; column, girder or beam; plain or decorated surface; and that in every instance it is the cheapest and quickest way.



**The negative hole-camera, in which the opaque spot on the intermediate glass casts an image, not of itself, but of the flame**

# Colorado's Six-Mile Tunnel Under the Rockies

## The Long-Deferred Realization of the Plans for an Air-Line Route from Denver to Salt Lake City

*By Theodore Merrill Fisher*

IN that epic, the story of the expansion of our borders and the development of the nation, there is no more fascinating chapter than the one dealing with the construction of the great trans-continental railroads. An outstanding figure in that romance is David H. Moffat; for, from the time of his arrival in the then village of Denver in 1859, he was intimately connected with the growth of the far west, and railroad building was with him a veritable passion. In 1867 he gave Colorado its first railroad outlet through a line connecting Denver with the Union Pacific at Cheyenne, Wyoming. Later he participated in the completion of the Denver & Rio Grande Railway and many of the local mountain lines that provided transportation facilities for what were then the newly discovered and booming mining camps of Colorado.

Coming down the years to 1902, we find him, at the age of 65, unlike most business men of his age, tackling his most ambitious enterprise, the connection of Denver and Salt Lake City by the most direct route. As a link in the shortest ocean to ocean line his plans had large national significance, their importance being immediately made clear by the bitter and relentless opposition that the Union Pacific and the Santa Fe systems offered because of the serious competition they promised. Although these interests were able to cripple his project by cutting him off from eastern financing, he went ahead as best he might with such local capital as he could gather, staking at the same time his own personal fortune on the success of the venture.

An important factor in Mr. Moffat's scheme—later to be seen as a determining one—was the driving of a long tunnel under the Continental Divide. As its cost was measured in terms of millions, the builders of the "Denver & Salt Lake Railway" were forced to adopt what they deemed but a temporary route over the main range of the Colorado Rockies.

When Mr. Moffat died in 1911, a broken man, he had been able to complete but 214 miles of this pet project, scarcely a third of its contemplated mileage. The "Moffat Road" became, then, merely a local line, spending three-fourths of its gross income in the almost unending struggle to keep its right-of-way over the "backbone of the continent" clear of snow, with the additional terrific handicap of a 6 per cent maximum grade. The scrap heap was the inevitable, final winding-up place for its affairs unless the great tunnel could be put through. We need not recount here the long story of the many unavailing attempts to see this accomplished through state aid or ownership. However, in May, 1922, the Colorado State Legislature passed an act that will assure the completion of the tunnel. This provides for the issuance of $6,720,000 in bonds for its construction, the same being guaranteed by all the private property of what has been designated as the "Moffat Tunnel Improvement District"—the northwest section of the state, including Denver—which is most immediately concerned with and which will most benefit from the putting through of the whole affair. Recently the last legal battle was won with the United States Supreme Court's finding that the basic law was constitutional, and so before this account sees print the Tunnel Commission will have construction contracts ready for bidding, if not actually let.

This incredible speed in getting things under way is due to the fact that the determination of the tunnel site will not, as is usually the case, have to be made a matter of months of surveying and preliminary engineering study. Major L. D. Blauvelt, who was for many years associated with the "Moffat Road," first as one of the original locating engineers, later as assistant to the chief engineer, and finally as chief engineer, went into the matter very thoroughly for his company, deciding upon three feasible sites and working out approach lines to each. After mature consideration of all the engineering and operating factors involved, one of these was selected. This judgment is made binding on the Tunnel Commission through the incorporation in the "law" of a provision which definitely names this site as the one that shall be used.

The tunnel's eastern portal will be about 50 miles from Denver, just beyond Tolland Station—where the road as at present operated begins its long and winding climb to the Corona Summit—and near the headwaters of South Boulder Creek. Between portals the length of the tunnel will be 6.04 miles, the west entrance being near the headwaters of Frazer River, one of the mountain sources of the Colorado River. The east portal is to be at an altitude of 9200 feet above sea level and the west 9100 feet; as Corona Summit is 11,660 feet in altitude, the tunnel will reduce the "Moffat Road's" maximum climb into the air by, roughly, 2400 feet and eliminate 23 miles of trackage. Aside from mastering the snow-clearance problem already referred to, the maximum grade on the entire line will be cut to 2 per cent. The saving effected by this will be made graphic by contrasting the present haulage of a 40-ton coal train from northwestern Colorado with the eventual situation. Whereas today it takes eight locomotives to get such a train over Corona Summit, eventually one only will be needed for haulage through the tunnel. In so doing away with the roads' chief handicap something like a half million dollars will be saved in yearly operating costs, and dependable transportation will, it is estimated, quickly double its business.

**The six-mile Moffat bore will throw into the discard a 23-mile stretch of track where the road now climbs the range, with grades as high as six per cent and constant struggle to keep the line open**

What is known as the "pioneer-bore" method of construction will be used by the builders of the Moffat Tunnel. This method, which was first devised in putting through the famous Simplon tunnel between Italy and Switzerland, and used for the first time on this continent by the Rogers Pass Tunnel on the line of the Canadian Pacific in British Columbia, requires the drilling of a smaller, auxiliary tunnel parallel to the primary operation. Where under the usual method work on the main bore is restricted to simultaneous drilling from the two ends, the faster progress of the "pioneer bore"—due to its much smaller diameter—permits cross cuts to be run out from it to the line of the main bore and double headings along the latter started from each of them.

Although many engineers are urging that the Moffat Tunnel be made a two-track artery, it will carry but one standard-gage line. The size of the tunnel will be 16 feet width, with a height of 20 feet above the rails; the auxiliary bore will be either 7 by 8 or 8 by 10 feet.

An innovation in engineering practice which the builders of the Rogers Pass Tunnel worked out will be used by those of the Moffat in its excavation. In place of the standard method of a top heading at each "face" and disposal of the "bench" by after blasting and power-shovel mucking, the following will be used: The floor of the pioneer bore and the cross cuts from it will be six feet above the level of the main tunnel as completed. Holding to the eventual center line of the latter, "pioneer headings" approximately eight by ten feet will be blasted at each "face." A follow-up drilling gang will then enlarge this preliminary adit to the full size required.

The undertaking is primarily a large-scale mining operation based on three eight-hour shifts. As the pioneer bore so materially facilitates the removal of the muck or spoils from the headings, progress becomes, in the main, a matter of drilling speed. It is estimated that from two to three years will be required to complete this great bore, at least a year's time being saved in comparison with the old, single-tunnel plan. As a single item the pioneer bore would represent a cost of about a million dollars, from which we deduct something like a half million dollars which its use will take off the cost of excavating the main tunnel.

The justification of the net cost of the auxiliary bore is found in the use which will be made of it as a water conveyor. Anticipating future domestic needs, the city of Denver has filed on water rights near the head of Frazer River across the continental divide. A tunnel of some sort would obviously be imperative to make the supply available, and in the usual course of events the city would later be compelled to construct it. With all available sources of supply on the eastern slope now appropriated and many thousand acres of farm lands inadequately supplied with water for irrigation, Denver's new supply, as soon as carrying facilities are ready, will be at once in demand. Until the time when domestic use is paramount, the city can derive an annual income of not less than a hundred thousand dollars from this source; consequently, it can well afford to pay a rental, for the use of the pioneer bore as a water conveyor, that will pay for its construction in a short term of years. To secure proper drainage of underground water, the peak of both tunnels will be near the center, the westward grade being .080 and the eastward .020. When the small bore is used for water conveyance purposes, to get the flow over the peak, an intake shaft a hundred and fifty feet deep will be necessary at the western portal.

Because the tunnel will be a public improvement purposed to serve as many uses as may be and free from possibility of monopoly, any railroad that wishes may use it. At the moment there is one road besides the Moffat whose interests are intimately connected with the building of the tunnel—the Denver & Rio Grande.

There is no question that, so far as the Moffat line is concerned, the putting through of the big bore will, after long years of frustrated plans and shattered hopes, bring about its completion, thereby opening up for development a vast area in northwestern Colorado and northeastern Utah, and establishing the full significance of the Moffat road in the general scheme of trans-continental transportation.

## Charles Doolittle Walcott

**By Marcus Benjamin, Ph. D.**

DURING the seventy-five years that have elapsed since the organization of the American Association for the Advancement of Science no less than twelve of the most distinguished geologists, beginning with William B. Rogers in 1848 and ending with Charles R. Van Hise in 1917, have been chosen to serve as its presidents. This year the Association again turned to a geologist for its leader.

Charles Doolittle Walcott, the youngest son of Charles D. Walcott and Mary Lane Walcott, was born in New York Mills, Oneida County, N. Y., on March 31, 1851. He is descended from Captain Jonathan Walcott, who came from Shropshire, England, and died in Salem, Mass., in 1699.

As a boy young Walcott developed a taste for natural history, and at the age of thirteen was already making systematic collections of fossils and minerals. His early education was received in the public schools of Utica, and in 1868 he was graduated from the Academy there, after which he spent two years in a hardware store in order to gain a commercial training.

It then became necessary for him to decide between a business career and one of research. A decision was quickly made and he settled in Trenton Falls, N. Y., where he made a collection of the unique limestone fossils from that locality, which later became the property of the Museum of Comparative Zoology, where it had been his intention to study under Louis Agassiz, but which was relinquished on the death of that great naturalist.

In November, 1876, he began his professional career as an assistant to James Hall, then State Geologist of New York, making thereafter extensive researches in New York, Ohio, Indiana and Canada. Three years later, in July, 1879, he was appointed field assistant in the U. S. Geological Survey, continuing in that service until his resignation in 1907, having held in succession the appointments of paleontologist in charge of invertebrate paleontology (1888), geologist in general charge of geology and paleontology (1893) and director (1894), in which last place he remained for thirteen years, reorganizing and developing the Survey on scientific and business principles.

During these years, besides much routine work, he examined and studied the Cambrian formations of the Appalachian belt all the way from Alabama to Quebec, and carried his researches on a more easterly line through New England and New Brunswick to Newfoundland. He also began a series of Western studies, which eventually included the most important bodies of Cambrian and pre-Cambrian rocks in Texas, Arizona, California, Idaho, Nevada, Montana, Wyoming and South Dakota. Later he turned his attention to a rich fossil locality in the Burgess Shale, near Field, British Columbia, from where he has obtained the finest and largest series of Middle Cambrian fossils ever discovered and the finest invertebrate fossils ever found in any formation. To the description of these fossils, including—besides brachipods and trilobites—merostomes, holothurians, medusae, annelids and malacostracans, he has devoted his leisure during recent years.

He is, therefore, best known as a student of the Lower Paleozoic (Cambrian) and pre-Paleozoic (Algonkian) sedimentary formations and included organic remains. He has himself described his work as follows:

"My own investigations have been mainly in the Cambrian and pre-Cambrian strata, and have involved new and somewhat startling discoveries that helped to show how very much earlier life was developed on our planet than we had previously supposed. These researches have taken into consideration the records left on all the continents and many of the great islands. Field work, with compass, hammer and chisel, has been the rule, followed by laboratory and critical comparison of many thousands of specimens of fossil genera and species of ancient marine life, and often study of microscopic sections of rocks and fossils, in the hope of finding evidence of the presence of minute and active bacterial and simple algal workers, such as exist in modern seas and lakes, which by their united efforts form great masses of the recent sea and lake deposits."

During the years 1902-7 Dr. Walcott had charge of the organization and conduct of the U. S. Reclamation Service, and also he had much to do with the development of the movement for the preservation of forests. It should also be mentioned that he was secretary of the Carnegie Institution of Washington during 1902-5—its formative period—after which he was a member of its Executive Committee, serving for a time as its chairman. The success of these important enterprises, to which he has so freely given of himself, has naturally gained for him just recognition as a great organizer and executive.

Soon after the death of Secretary Langley, the necessity of finding someone especially competent to undertake the task of administrating the important work of the Smithsonian Institution naturally turned all eyes towards Dr. Walcott, not only because of his known and tried ability, but also because of his long association with the National Museum as a curator, and of which he was in charge in 1897-8, subsequent to the death of Dr. G. Brown Goode. His selection by the Regents was thoroughly approved by the scientific world, and ever since his acceptance of the onerous duties that have devolved upon him as Secretary of the Smithsonian Institution and its dependencies they have been performed with rare fidelity and the utmost satisfaction. He has devoted much of his attention to the research explorations of the Institution, and among these the African Expedition of 1909-10 under Colonel Theodore Roosevelt is the one most widely known. That he may live long and continue to contr ute his valuable energies to the administration of science is the abundant testimony of his colleagues in Washington.

Charles D. Walcott, incoming President of the American Association for the Advancement of Science

Dr. Walcott's activities in other directions are many, but of two specific mention must be made. During the period of the World War he became chairman of the National Advisory Committee for Aeronautics, and he was chairman of the military section of the National Research Council.

The results of his many investigations have been given to the world chiefly through the publications of the U. S. Geological Survey or the Proceedings of the U. S. National Museum, and more recently, the Smithsonian Miscellaneous Collections, and in addition to these sources there have been frequent papers in the *American Journal of Science* and similar publications, both at home and abroad. His entire bibliography is therefore quite extensive and includes more than one hundred titles of major importance.

His scientific attainments have received deserved recognition by the conferment of the Hayden medal in 1905 of the Academy of Natural Sciences in Philadelphia, the Bigsby medal in 1895 and the Wollaston medal in 1918 of the Geological Society of London, and the Gaudry medal in 1917 of the Société géologique de France. Academic appreciation of his distinction is shown by the following honorary doctorates: in law from Hamilton (1897), Chicago (1901), Johns Hopkins (1902), Pennsylvania (1903), Yale (1910), St. Andrews, Scotland (1911), and Pittsburgh (1912); doctorates in science from Cambridge, England (1909) and Harvard (1913) and a doctorate in philosophy from the Royal Fredericks University of Christiania in 1911.

Societies and academies have been proud to add his name to their lists of distinguished members and in addition to the London Geological Society and the Société géologique de France, he holds honorary or corresponding relationships in the Royal Geographical Society of London, the Moscow Imperial Society of Naturalists, the Christiania Scientific Society and in the academies in Bologna, Rome, Stockholm and Paris, in the latter of which he is one of the very few American corresponding members. At home he is an associate fellow of the American Academy of Arts and Sciences, a vice-president of the American Philosophical Society and a past president of the National Academy of Sciences. Also he was president of the Washington Academy of Sciences (1899-1910) and of the Archaeological Institute of America (1915-17). He has served as president of the Cosmos Club (1898).

His connection with the American Association for the Advancement of Science began with his election to membership at the Buffalo meeting in 1876, and six years later he was advanced to the grade of fellow. In 1893 he presided over the section on Geology and Geography and delivered an address on "Geologic Time as Indicated by the Sedimentary Rocks of North America." At the meeting held in Boston last Winter he was chosen president of the Association, thus confirming his standing as the foremost geologist of America, a fact further certified to by the statement made when he was presented with the Wollaston medal that "his personal researches have excited interest and admiration wherever geology is cultivated."

## Physiological Effects of High Temperatures

VENTILATION is of little use in reducing discomfort from high temperatures in humid air, after the temperature has risen to approximately that of the human body, according to a report of recent experiments made by the United States Bureau of Mines on the physiological effect of high temperatures with and without air movement. In temperatures up to 95 degrees the movement of air caused much relief. At 100 degrees the symptoms were fully as severe with moving air as with still.

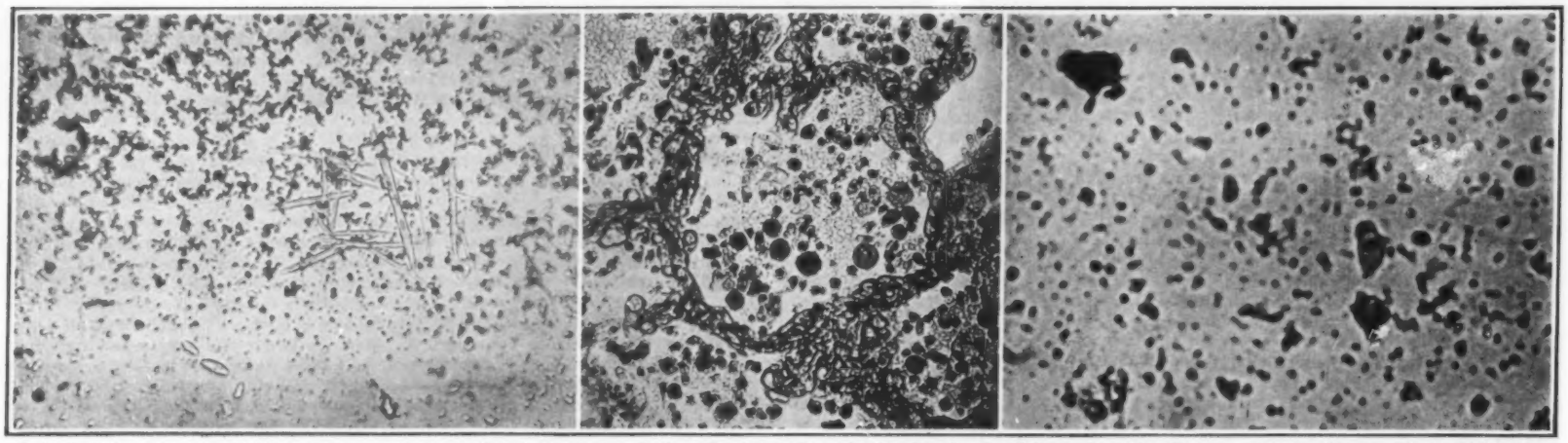
The experiments were carried out by Dr. R. R. Sayers, chief surgeon of the Bureau of Mines, and D. Harrington, supervising mining engineer. The subjects were experienced mine laborers. The work was carried on in deep and hot metal mines.

The principal effects of exposure to hot, humid and stagnant air were a rise in the body temperature of two or three degrees, a fall in blood pressure, perspiration so profuse that the subjects' shoes were partly filled with sweat, and sensations of giddiness and weakness. These symptoms were all very pronounced at 95 degrees in stagnant air. If the air were in moderate motion, little discomfort was felt.

This was not the case, however, at temperatures of 98 degrees and more. Symptoms in still air, which were more trying than at the lower temperatures, were not much relieved by a current of air, while at 100 degrees they were so unbearable that even when the air was moving the subjects were not able to stand a full hour's exposure to the conditions.

More recently a more thorough study of the effect of high temperature has been made possible through the use of a specially designed room where any desired conditions of temperature, humidity and air movement which are likely to be met may be maintained.

From this a system of "comfort lines" is being worked out, a graphical representation of the combinations of temperature and moisture at which equal comfort is experienced. It has been shown that while humidity has a marked influence, the temperature taken by the ordinary dry-bulb thermometer is of great importance. The discomfort experienced is shown to be due more to the increase in the pulse rate than to any other cause, according to findings of Dr. Sayers of the Bureau of Mines, and D. Harrington, supervising mining engineer.



*Left*: Dust from a mine-ventilating shaft, magnified 2000 diameters. *Center*: Section of a human lung, showing deposits of coal-dust and soot in cell tissues, with magnification of 200. *Right*: Dust that drifted with the wind across the North Sea to England: magnification, 1000 diameters

**A few rather surprising samples of the air we breathe, showing its dust content**

# The Air We Breathe

## New Types of Apparatus for Measuring the Suspended Dust in the Atmosphere

*By John B. C. Kershaw*

FEW of us are unfamiliar with the old experiment of allowing a beam of sunlight or of some strong artificial light to pass through a small opening in a shutter into a darkened chamber or room, and with the accompanying revelation of the countless millions of dust particles which float suspended, but in perpetual movement, in the air. It is not so generally known, however, that the study of this suspended matter of the atmosphere is now being placed upon a more scientific basis, and that instruments have been devised and are now in use which permit the number of these suspended dust particles to be accurately recorded, and their character to be examined.

It has, of course, been known for many years that the finer particles of soot and ash discharged from high factory chimneys could be carried by wind and air currents for many miles over the surrounding countryside; but the distance at which vegetation ceased to be destroyed or checked was supposed to mark the extent of this transport of injurious dust and vapor in the neighborhood of industrial towns and districts. Some experiments carried out last year, however, by Dr. Owens of the British Meteorological Office seem to indicate that the finer suspended dust particles of air can be carried to much greater distances than has hitherto been supposed, and that under favoring circumstances and atmospheric conditions, they may even be transported across hundreds of miles of sea, and thus pass from one country to another. The dust particles shown in our first illustration, which Owens found in the air on the East Norfolk coast, in his opinion were not of local origin, but had traveled across the North Sea on easterly air currents and had come probably from the smoke discharged by factory chimneys of Belgium or Germany.

It is well, therefore, to take cognizance of these new methods of dust observation, and of their results. If the comparatively harmless fine ash and dust particles from industrial centers can be carried by air currents for such great distances over intervening seas and oceans, disease germs and other deleterious dust particles may be disseminated in the same manner; and the possibilities of infection or attack by air will have to be studied from quite a new standpoint. Some of the mysterious outbreaks of infectious disease in the past may be due to air-borne germs, and not to infection by contact.

The instruments which have been devised by Dr. Owens for the collection and examination of the suspended matter in the air are highly ingenious. In the case of his air-sampler, the difficulty caused by the relative smallness of the amount of suspended impurity in the air in comparison with the volume of the air which contained it was overcome by reducing the area of the filter-paper used to very small dimensions—to a diameter of one millimeter, in fact. The paper was clamped tightly between the two brass parts of the apparatus by turning a milled-head screw, and 2000 cubic centimeters of air was then drawn through the very minute area of filter-paper exposed between the two openings of the brass headpiece of the apparatus, a water-aspirator being employed for this purpose. A distinct coloration of the paper was thus produced even by what appeared to be a clean and dustless atmosphere; and by use of a scale of numbered tints, ranging from pale gray to black, a record was obtained and filed for reference of the amount of suspended dust or dirt in the atmosphere at the time of the observation. A later model is operated on the same principle, but is automatic in action, and takes a series of records of the suspended dust in the atmosphere over a period of twelve or twenty-four hours, at predetermined intervals.

The Owens jet apparatus for air examination depends for its action upon the fact that when air which contains dust and a sufficient amount of water vapor has its pressure suddenly reduced, there is a fall of temperature and a condensation of moisture upon the dust. If the dust particles thus enveloped in moisture be brought into contact with a glass surface, and the moisture be then evaporated, the dust will adhere and can be examined microscopically. In the Owens instrument this result is brought about by causing a very fine ribbon-shaped jet of air to strike a microscope cover-glass, placed about one millimeter from the opening forming the jet. The air before entering the jet passes through a damping-chamber, and the velocity in the jet is such that the fall of pressure results in bringing about a condensation of moisture on the dust at the moment of striking the cover-glass. The air is then deflected, and as the velocity falls off, the pressure and temperature rise, the water is evaporated, and the dust which it has abstracted from the air is left behind as a deposit on the glass.

**The Owens automatic air filter, with attachment raised for charge of recording disk**

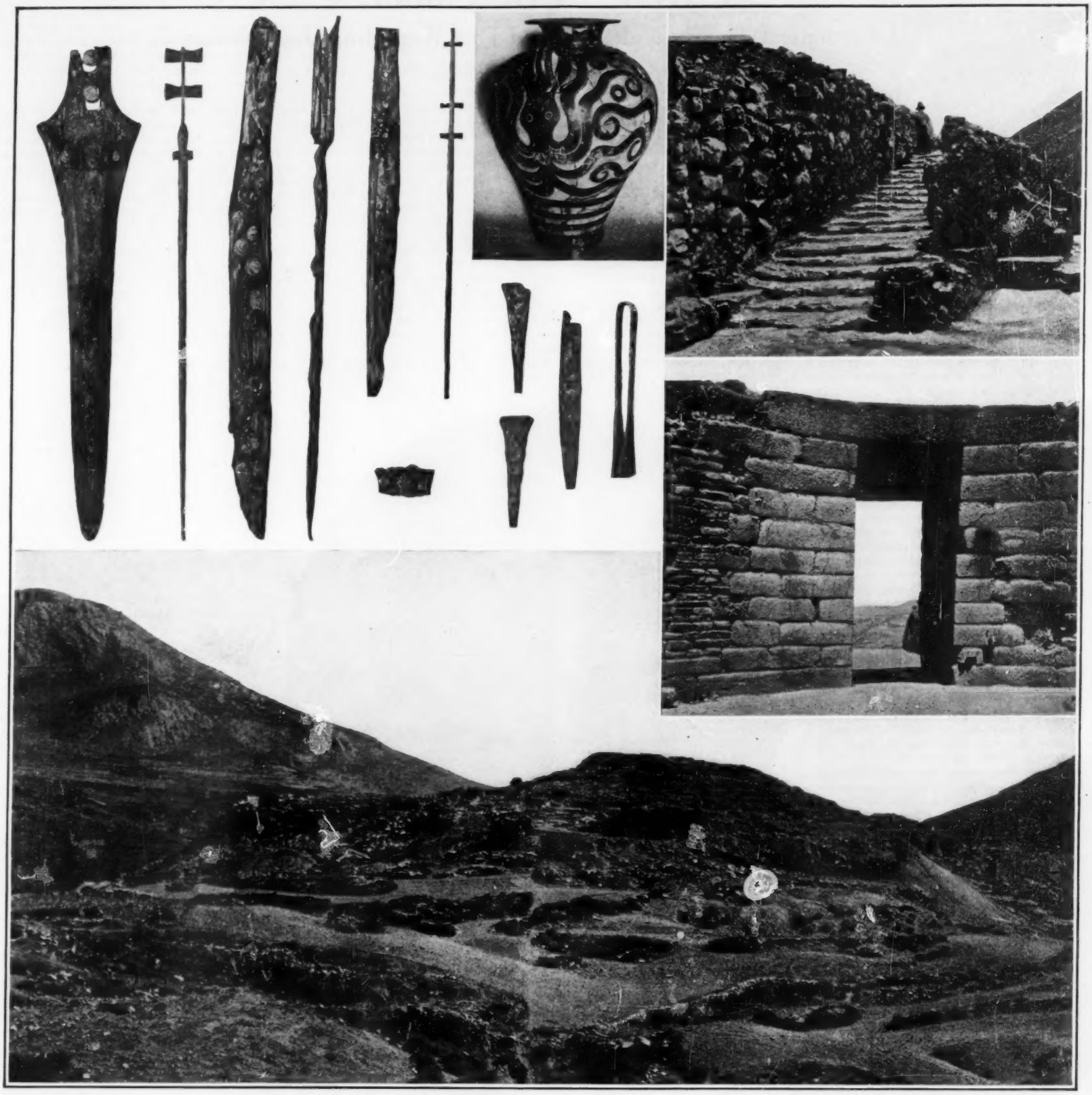
The apparatus is so arranged that the record consists of a linear deposit of dust, and a count of the number of particles may be made by the aid of the eye-piece micrometer, a strip being counted completely across the record at several places and an average taken, to be multiplied by a factor depending upon the length of the strip and the spacing of the sample countings.

It appears probable from the tests already made by Owens, and detailed in his original paper contributed to the Royal Society in November, 1921, that the presence of suspended dust in the air is one of the chief governing factors of visibility on occasions when there is no water fog to obliterate vision at short distances. On several occasions when the visibility in country districts was bad, and a distinct gray or bluish haze was seen against distant objects, the tests revealed the presence of abnormally large numbers of dust particles in the air.

Another application of the apparatus is in the examination of expired air, with a view to ascertaining whether the suspended impurities in the air breathed are retained or expired. The experiments made so far indicate that the tidal air expired contains a large proportion of the suspended matter which was inspired; while the "reserve" air from the deeper parts of the lungs, while containing very much less than the tidal air, still contains also some of the suspended matter breathed in. An important result obtained was that the quantity of dust in the deep parts of the lungs depended chiefly upon the nature of the breathing; that is, "deep breathing" from any cause carried dust into the deeper parts, and even the last part of reserve air under such conditions was found to be laden with dust.

Other applications of the Owens jet apparatus are for the examination of fumes from smelter chimneys and of mine dust, and for the determination of the vertical distribution of the suspended matter in air. The whole apparatus is small and light, and a record can be taken with it in a few seconds, at any place or in any position. The microscope slip with its deposited dust can then be labeled and numbered and the examination of the deposit carried out at leisure under more comfortable conditions in the laboratory.

When necessary, reagents may be applied in order to identify the nature and character of the deposited dust particles, working in accordance with microchemical methods of analysis; and in this way much valuable information may be obtained as to the best methods of treating and removing the dust or fume from the air which contains it. The presence of harmful bacteria and disease germs in abnormal numbers may also be detected by the jet apparatus, and the necessary measures or precautions taken for defence against them.



AT Mycenae, the city of Agamemnon, new pages of history are being uncovered according to Mr. A. J. B. Wace, Director of the British School of Archaeology at Athens, which has been making new excavations at this classical site. In the private apartments of the palace a tank-bath lined with red stucco was discovered. Here were found the bronze daggers and the vase which we picture. Extraordinary domed tombs were found which show an elaborate system of counter-weighting and wedging the stones that inclined inward to make the dome. Even at this early date Mycenaean engineers and architects had both imagination for drawing plans and knowledge for making calculations and construction. The palace on the summit of the Citadel now appears to have been a large building with several stories. The palace was built about 1400 B. C. Other work included the excavation of the fort or signal station on the summit of Mount Hagios Elias (2500 feet) whence the news of the fall of Troy might have been flashed by fire-signal to Mycenae below. An examination of the tombs show that the later members of the family seemed to have had no scruples in sweeping aside, or even throwing outside the bones and other relics of the earlier interments and appropriating valuables.

Our photographs show the ancient Greek weapons recently found in Mycenaean tombs, as well as a vase or jar with a highly realistic octopus design. The topmost right-hand photograph shows what was once the approach to Agamemnon's throne room—the great south stairway of the Palace of Mycenae. The drawing below it shows the building technique of the 15th century B. C., in this case the door of the "Lion Tomb." The large view shows the Citadel, on the mountain at the left. We are indebted to *The Illustrated London News* for the photographs and data.

**MYCENAE, THE CITY OF AGAMEMNON, AS BROUGHT TO LIGHT BY THE ARCHAEOLOGISTS**

# The Heavens in December, 1923

## Mathematical Theory and Observed Fact Regarding the Nebulae

*By Professor Henry Norris Russell, Ph.D.*

WE spoke last month of the spiral nebulae—their strange forms, stranger motions, and enormous size. No one could follow such a story without the instinctive question, "But what are these nebulae? Have we any idea of their real nature?

Though this bold query cannot be answered with assurance today, we are by no means in utter uncertainty. The astronomical world possesses a theory of their nature which matches the principal facts so well that, though "not proven," it commands the sympathy and indeed the belief of the most competent authorities.

Perhaps the most remarkable feature of this theory is its origin. For once, we come on the rare case of a hypothesis of great practical attractiveness which originated, not from a study of the bodies to be explained, but from purely theoretical considerations developed in the investigation of a highly generalized problem.

We refer, of course, to the remarkable work of Jeans—one of the most distinguished of English mathematicians, who has hardly a rival in that difficult field where mathematics, physics, astronomy and geology may dispute the sovereignty. The abstract problem which he was discussing was the old and intricate one of the behavior of a mass of rotating fluid. Such a mass, if isolated in space, would settle down, under its own gravitation, into some definite "figure of equilibrium." If the mass was not rotating at all, this figure would obviously be a sphere. If the fluid was incompressible, its density would be the same everywhere; if compressible, it would be denser—probably much denser—at the center, but still spherical.

Let us now suppose the mass to be in slow rotation. The problem is more complex; we have a centrifugal force, acting outward in the plane of the equator, combining with gravity. It is easy to see that, if small, this force will make the body bulge out at the equator and flatten down at the poles. But the amount of the bulging is not easy to compute, for the very change of shape alters the gravitational attraction at the surface. For slow rotation, however, the problem was solved a century ago—at least, for the homogeneous mass. The cross-section, along a meridian, becomes an ellipse, while the equator is still a circle. The earth and Jupiter, though denser toward their center, illustrate this case.

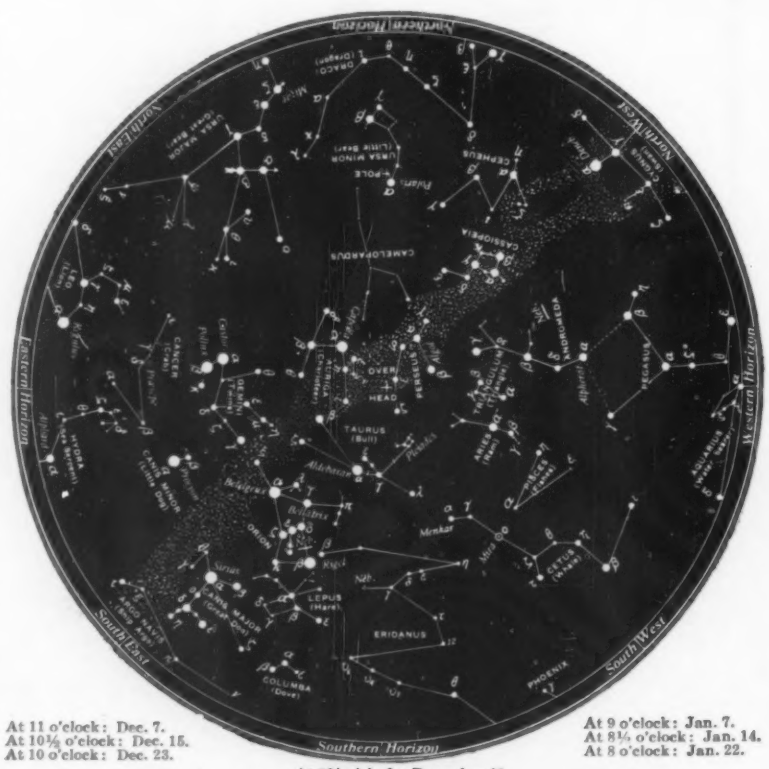
### Figures of Equilibrium

But what if the rotation grows more rapid—as must actually happen if the mass cools down and contracts? In this event, a homogeneous mass will become more and more flattened at the poles, with its equator circular, until it reaches a certain limiting shape; and then a strange thing happens. The equator itself becomes elliptical, and the mass resembles in form a cake of toilet soap, rotating about its shorter axis. With increasing rotation, the long diameter of the equator becomes twice, and even three times, the other; so that the figure is almost cigar-shaped. Then again a change occurs. One end of the "cigar" tends to elongate and the other to become short and thick. At this point the mathematical analysis becomes appallingly complicated, and it was not until Jeans attacked the problem (a little matter of a year or two of calculation) that it was cleared up.

Beyond this point, he finds, there can be no real equilibrium at all. One end of the "cigar" lengthens rapidly, the other fattens, and a neck forms between them. Doubtless this neck soon breaks, and we get two independent masses, rotating about one another, and almost in contact—after which the friction of the tides which they raise on one another will drive them slowly apart, as Darwin showed years ago.

Practically every stage beyond the point of actual separation is exhibited to us among the eclipsing variable stars. But these stars are formed of compressible gas, and must be condensed toward their centers. How will this affect things?

This problem is even a more difficult one than the other, but Jeans has successfully attacked it. If the central condensation is small or moderate, the course of events follows essentially the line already sketched. But if the outer parts are of low density and the central condensation great, the whole story changes. For slow rotation the shape is much as before; but as it spins faster, the sharply curved part of the surface becomes more and more localized at the equator, and it comes to resemble a double-convex lens (or a reading-glass without the frame). Finally the equatorial edge, at first rounded, becomes quite sharp. At this stage the centrifugal force at the equator just balances gravity; and for any further rotation something must break loose. For a mass quite isolated in space, the surface portions would begin to spread out in the plane of the equator into a wide, flat sheet. But no actual body, even in interstellar space, is quite isolated. The attraction of the neighboring stars, at least, must act upon it, and produce forces of the same nature as those which raise the tides in our oceans. The outer edges of the lens-shaped mass, in this critical state, will be very sensitive to the smallest forces; and the outcome is that the outflow of matter, thrown off by the rapid rotation, will take place at two opposite points on the equator, the "high-tide regions," so that it will escape, not in a sheet, but in two oppositely directed streams. If the quantity of outflowing material is small, it will dissipate into space; if it is large, the mutual attraction of the particles will keep the stream from spreading out laterally, and it will form a long filament. There is, however, a strong tendency for such a filament to break up longitudinally into separate bits, just as a narrow jet of water (under quite different forces) breaks up into separate drops. So our rotating mass, if huge enough, will surround itself with a swarm of small condensations arranged in streams along the bulk of the filaments from which they have been formed, and issuing from two opposite points on the periphery of the central mass.




At 11 o'clock: Dec. 7.
At 10½ o'clock: Dec. 15.
At 10 o'clock: Dec. 23.

At 9 o'clock: Jan. 7.
At 8½ o'clock: Jan. 14.
At 8 o'clock: Jan. 22.

At 9½ o'clock: December 30.

NIGHT SKY: DECEMBER AND JANUARY

### Mathematics and the Nebulae

All this came as a definite, but in a sense unexpected, result of Jeans' mathematical reasoning. The resemblance of the resulting picture to that actually presented by the spiral nebulae is striking to a degree. Indeed, almost every form predicted by the theory, from the globular mass, through the sharp-edged one, to the nucleus surrounded by innumerable condensations, can be found repeatedly on nebular photographs. If such a success was not enough, it must be added that Jeans, assuming (as seems reasonable) that the condensations in the spiral arms of the nebulae are as big (or, rather, as massive) as stars, finds it possible, from general considerations, to work out roughly the size of the nebula and the rate at which it is throwing off matter from its rim. He is thus led to estimate that the distances of the great spirals in Andromeda and Ursa Major are of the order of 3000 and 5000 light-years, which is consonant with what other information we can get upon the matter; while the masses of the nuclei must be enormous—in the Andromeda nebula, perhaps a billion times that of the sun.

No other theory of spiral nebulae has so far been proposed which is anything like as satisfactory. But many difficulties remain. One is found in the fact, clearly proved by van Maanen, that the motions in the outer parts of the arms increase as if athwartwise force was acting upon the particles. Another is that the spectra of the central portions are just what might be expected from a cluster of stars generally similar to the sun. Yet at the probable distances of these nebulae, the individual stars should be shown on our photographs (unless they were all much fainter, intrinsically, than the sun). Twenty years hence, or even ten, there may be other chapters to add to our story, equal in interest to any that have so far been read.

### The Heavens

The winter skies are now in their full glory. Orion blazes high in the southeast, with Taurus above and Sirius below. Procyon, Castor, Pollux and Regulus are all in the east—the last rising. The Great Bear ascends in the northeast, the Dragon swings low in the north, and Cassiopeia and Cepheus are sinking in the northwest, above Cygnus, which is setting. Auriga and Perseus are overhead, Andromeda, Aries and Perseus in the west. The southwest, with the sparse stars of Eridanus and Cetus, is the only dull part of the sky.

### The Planets

Mercury is an evening star all the month, but is so far south that he will be hard to see. The best time is about the 27th, when he is farthest from the sun; but even then he sets at 6 P. M.

Venus is also an evening star, but is further from the sun than Mercury and much easier to see. By the end of the month she remains in sight until 6:45, and should be easy to see just about dark.

Mars is a morning star in Virgo, rising at 3.30 A. M. in the middle of the month. On the first he is in conjunction with Saturn. The two planets are 1½° apart and should present a pretty spectacle.

Jupiter, too, is a morning star, but much nearer the sun, and does not rise until nearly 6 A. M.

Uranus is in Aquarius, and is in quadrature east of the sun on the 6th, so that he can be observed all the evening. Neptune is in Leo, and rises about 9 P. M. in the middle of the month.

The moon is in her last quarter at 5 A. M. on the 1st, new at 8 P. M. on the 7th, in her first quarter at 10 P. M. on the 14th, full at 3 A. M. on the 23rd, and in her last quarter again at 4 P. M. on the 30th. She is nearest the earth on the 6th, and farthest away on the 19th. During the month she passes near Saturn and Mars on the 4th, Jupiter on the 6th, Mercury on the 8th, Venus on the 9th, Uranus on the 14th, and Neptune again on the 26th.

At 3:54 P. M. on December 22nd the sun reaches his greatest southern declination, and enters the sign (though not the constellation) of Capricorn—and, in almanac language, "winter commences."

Princeton, N. J.
Oct. 1, 1923.

## Metering Water by the Wholesale

VAST quantities of water are used by modern large hydroelectric power plants and the problem of metering this water, wherever this is required, is not such a simple matter as would at first thought appear. Several methods have been used but none has been satisfactorily accurate when the work involves such large amounts of water. In factories, water is often weighed in tanks, made to tip automatically when filled and spill the water into other receptacles. Nothing like this could possibly be used in such large power installations as, for instance, a certain one which uses 3500 cubic feet of water per second.

A new method of measuring water has been worked out by Professor C. M. Allen, of Worcester Polytechnic Institute and in practice has given remarkably accurate results. Common salt or sodium chloride increases the electric conductivity of water and this increase is in direct proportion to the amount of salt in solution. Brine is introduced into the pipelines at a considerable distance upstream and automatic timing devices record the changing conductivity of the brine as it passes given points at which electrodes are inserted on opposite sides of the line. By dividing the volume of the pipe between the two points by the rate of passage, the rate of flow is arrived at. When tested against the weir and Venturi meter the new method is found to be very accurate. It proves superior to the method of measuring stream flow by the submerged float method and it is vastly better than the method which requires expensive tanks.

## Pulling Down a Church Steeple With a Motor Winch

A STRIKING example of the all-around usefulness of motor truck winches was brought to light the other day in Jamestown, N. Y. The Presbyterian Church, one of the city's old landmarks, was being wrecked to make way for a new hotel. Higgins & Haupin, contractors for the job, swung a heavy cable from the top of the steeple to a motor truck winch mounted on a six-ton motor truck. On the first attempt to pull the steeple over the cable snapped. A new cable was attached. The winch, operated by the truck engine, wound slowly around. After straining and cracking for about three minutes, the steeple fell with a crash that could be heard for several blocks.

Small capstan winches, operated on the motor's idling power, are coming into widespread use as regular equipment on motor trucks. They are used for a surprising number of jobs, from loading trucks to hauling heavy boilers; from hoisting safes to wrecking buildings.

## Chewing Up the Soil for Better Crops

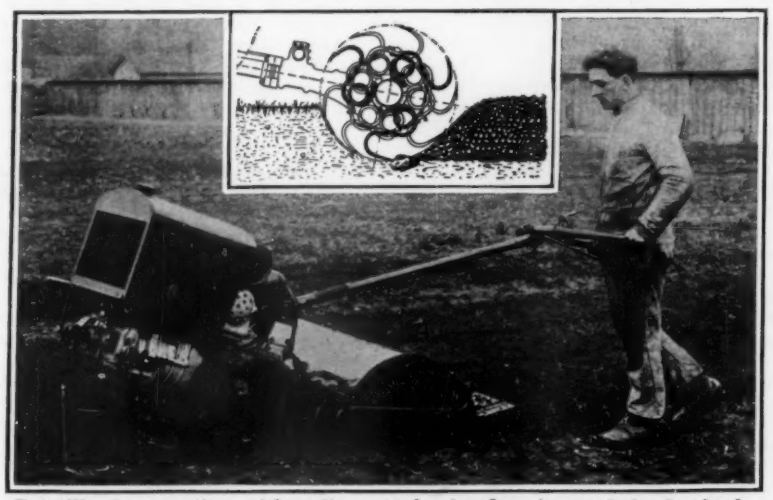
ON the American market today there are several different manufactures of garden tractors, and now from England comes the description of one which differs radically from the American variety in that the soil is worked by a revolving member called a miller, instead of by the common toothed cultivating attachment. The function of the miller is to chew up the soil, mixing, lightening and incorporating it thoroughly with the fertilizer that has already been spread over it.

The rototiller is driven by a two-cycle, 8 to 10 horsepower engine. Lubrication is provided by mixing the oil with the gasoline in the tank, as in small engines used on motorboats. The engine is cooled by means of a radiator of two gallons capacity and by a fan running on ball-bearings. Ignition is by high-tension magneto. As in the case of the garden tractor, the controls are led to the handlebars. The motor is equipped with an air-cleaner working on the labyrinth principle.

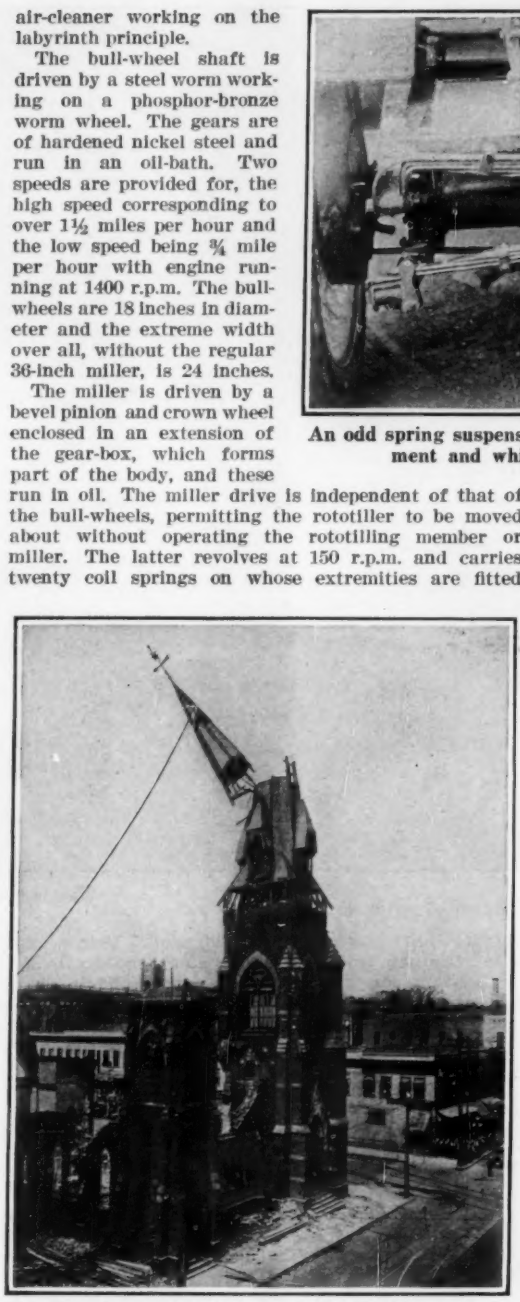
The bull-wheel shaft is driven by a steel worm working on a phosphor-bronze worm wheel. The gears are of hardened nickel steel and run in an oil-bath. Two speeds are provided for, the high speed corresponding to over 1½ miles per hour and the low speed being ¾ mile per hour with engine running at 1400 r.p.m. The bull-wheels are 18 inches in diameter and the extreme width over all, without the regular 36-inch miller, is 24 inches.

The miller is driven by a bevel pinion and crown wheel enclosed in an extension of the gear-box, which forms part of the body, and these run in oil. The miller drive is independent of that of the bull-wheels, permitting the rototiller to be moved about without operating the rototilling member or miller. The latter revolves at 150 r.p.m. and carries twenty coil springs on whose extremities are fitted twenty semi-circular hooks of steel. These are the tools which attack the soil. The total weight of the machine is 650 pounds and its height is 37 inches.

One of the most satisfactory qualities of this cultivating device is its low speed. In order to do good work a garden tractor should not be geared so as to run as fast as three miles per hour—a speed at which the control of the tools is erratic, especially in rough or lumpy soil, therefore the low speed of the rototiller is an advantage.



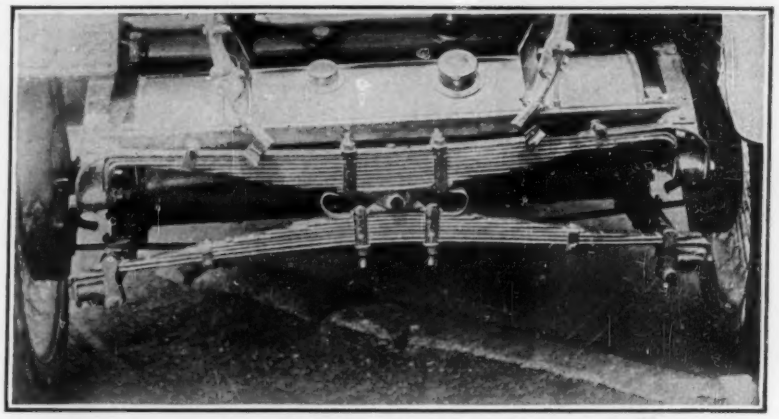
Rototiller in operation, with a diagram showing how its semi-circular hooks tear up the soil and leave it in a pulverized, aerated condition for planting



This church steeple is being pulled down by means of a motor-truck winch and heavy cable

## Talc

TALC is by no means used only for the manufacture of talcum powder. Much of it is unsuitable for this purpose and is used in paint as a body material, for filling paper, for use in the manufacture of rubber, and roofing. Much of the talc used comes from northern New York, Vermont and Virginia. The talc rock of New York is mined and brought to the talc mill where it is ground in ball mills until it will pass a 325-mesh sieve.



An odd spring suspension which takes the place of the usual shackle arrangement and which is said to make for greater riding comfort

## Taking the Roughness Out of Ruts

STILL another device for taking the roughness out of ruts now makes its appearance. This time it is in the form of a new type of automobile spring suspension, worked out by L. H. Timmons of Des Moines, Ia.

Constructed on the theory that unsprung weight is the enemy to riding comfort, Timmons, through the medium of rolling contact bearings and relief springs, has evolved a type of spring suspension which is shown in the accompanying illustration. The rear auxiliary relief spring, here shown, is composed of double transverse straight laminated springs, secured at their centers with a roller bearing oscillating joint between. Each end of the upper spring is connected to the side frame by means of a roller bearing device. The lower springs are held in contact with the side springs by a rubber padded stirrup with a ball bearing between the springs, making a frictionless connection and allowing a greater range of spring or axle movement than with the usual construction.

The front relief spring is a quarter elliptic laminated spring attached to the rear end of the present semi-elliptic side spring by a connection encasing a barrel-shaped roller bearing, the thick end being rigidly attached to the frame. The effect of this combination, according to the inventor, is the same as that of a long straight spring, since the arrangement allows double the ordinary range of spring movement. In this manner noiseless spring connections take the place of spring shackles which are subjected to heavy loads. Snubbers from axle to frame prevent excessive changes from normal positions.

## Asphaltic Types of Pavement

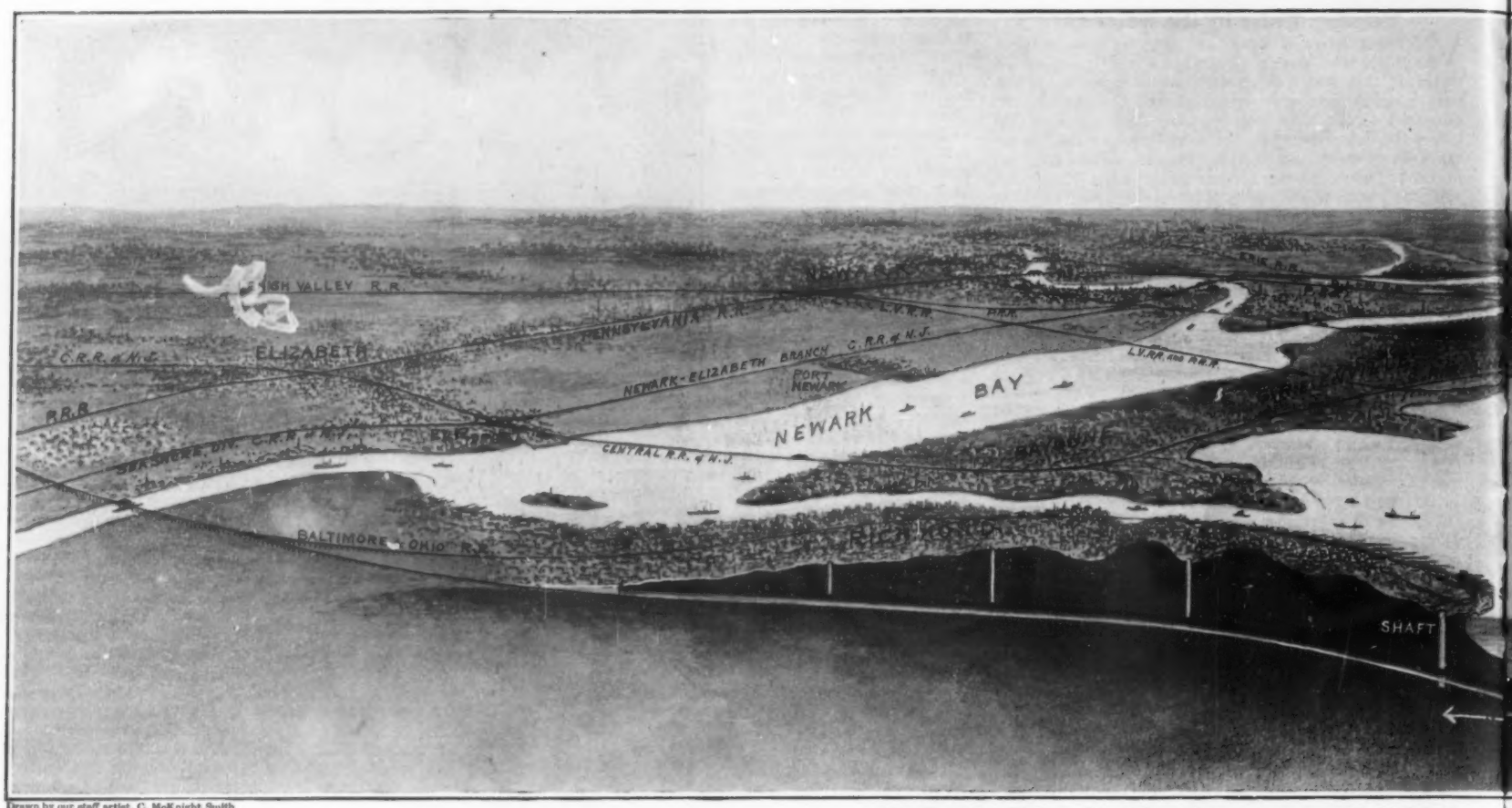
IN 290 leading cities of the United States there is enough pavement to cover an eighteen-foot street that would twice encircle the globe. This mileage by far exceeds that of every other country of the world. Of this total amount of pavement, 78 per cent is of the type higher than waterbound macadam, including about 22 per cent of brick, 11 per cent of stone block, 3 per cent of wood block, about 6 per cent of portland cement concrete, 2.5 per cent of tar macadam and 54 per cent of asphaltic types.

The overwhelming predominance of the asphaltic types of pavement indicates the determination of modern cities to eliminate dust, noise, shock and interruption to traffic in street construction as far as possible.

The vast network of underground structures in American cities, including wires, pipes and conduits, make it necessary to open the pavement at frequent intervals to obtain access to these underground services. The engineer must, therefore, provide a pavement which can be cut through without great trouble and expense, which can be readily repaired and which, after it has been repaired, blends with the old pavement.

For fast moving traffic the modern city pavement must be smooth, not only to permit the rapid and comfortable movement of vehicles but to conserve motor fuel and tires. Only a slight saving in the operating cost per motor vehicle by reason of the smooth pavement reaches an aggregate, when the vast number of motor cars is considered, to justify a considerable outlay to obtain durability and smoothness.

Impact, or the pounding of heavy motor truck wheels, has attracted the anxious attention of city highway engineers to an increasing degree during the past ten years. A truck wheel with a drop of only one inch when in motion delivers a blow equivalent to at least six times the dead weight. City engineers, therefore, attach increasing importance to the flexibility and resiliency of city pavements so as to take up the shock of impact.




Drawn by our staff artist, C. McKnight Smith

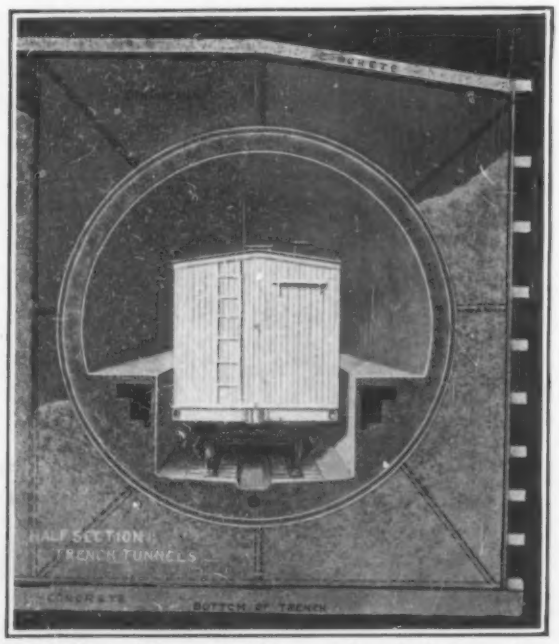
**The Brooklyn-Richmond freight and passenger tunnel, which is to pass Narrows,**

# The World's Largu ba

## Building a $60,000,000 Freight Pass the Narrew Yo

IN the presence of the Mayor of New York and other city officials, ground was recently broken for the construction of the shaft at the Brooklyn end of a $60,000,000 freight and passenger tunnel which is to be built under the Narrows to Richmond, Staten Island. The location of this shaft is at Shore Road and Bay Ridge Avenue.

Thus was inaugurated the construction of what will be one of the largest subaqueous railroad tunnels in existence, and if we include the land portion of the tunnel, the whole structure takes rank as among the largest railroad tunnels in existence. In 1921, the New York State Legislature directed the Board of Estimate of New York City to begin, within two years, the construction of this tunnel, with a view "to maintaining the supremacy of the Port of New York." Immediate study was made by a corps of engineers of the project, and the actual construction work has been started within the alloted time originally set.




**Section through tunnel built by trench method. It consists of a plate steel tube stiffened by steel diaphragms, the whole being encased in concrete**

The route chosen for the tunnel contemplates a railroad of first-class construction from Bay Ridge, where it will connect with the Long Island Railroad, and also with the Fourth Avenue Brooklyn Rapid Transit subway, to Arlington, on Staten Island, where it will join up with the Baltimore & Ohio Railroad, the total length of the railroad being ten miles. We have prepared a bird's-eye view, taken from a position south of the Narrows and looking north across upper New York Bay, and including the greater part of the metropolitan district.

The foreground of the picture presents a vertical section taken through the site of the proposed tunnel. Its eastern entrance lies about 4000 feet back from the shoreline of the Narrows; then it falls on an even grade until it reaches a point well below the bottom of the Narrows. On the Staten Island side the tunnel passes below the range of hills which runs generally north and south through Staten Island, and then emerges and continues as a surface railroad to a junction with the Baltimore & Ohio Railroad, crossing the Kill Van Kull to New Jersey by means of a bridge with suitable openings for steamships and other traffic.

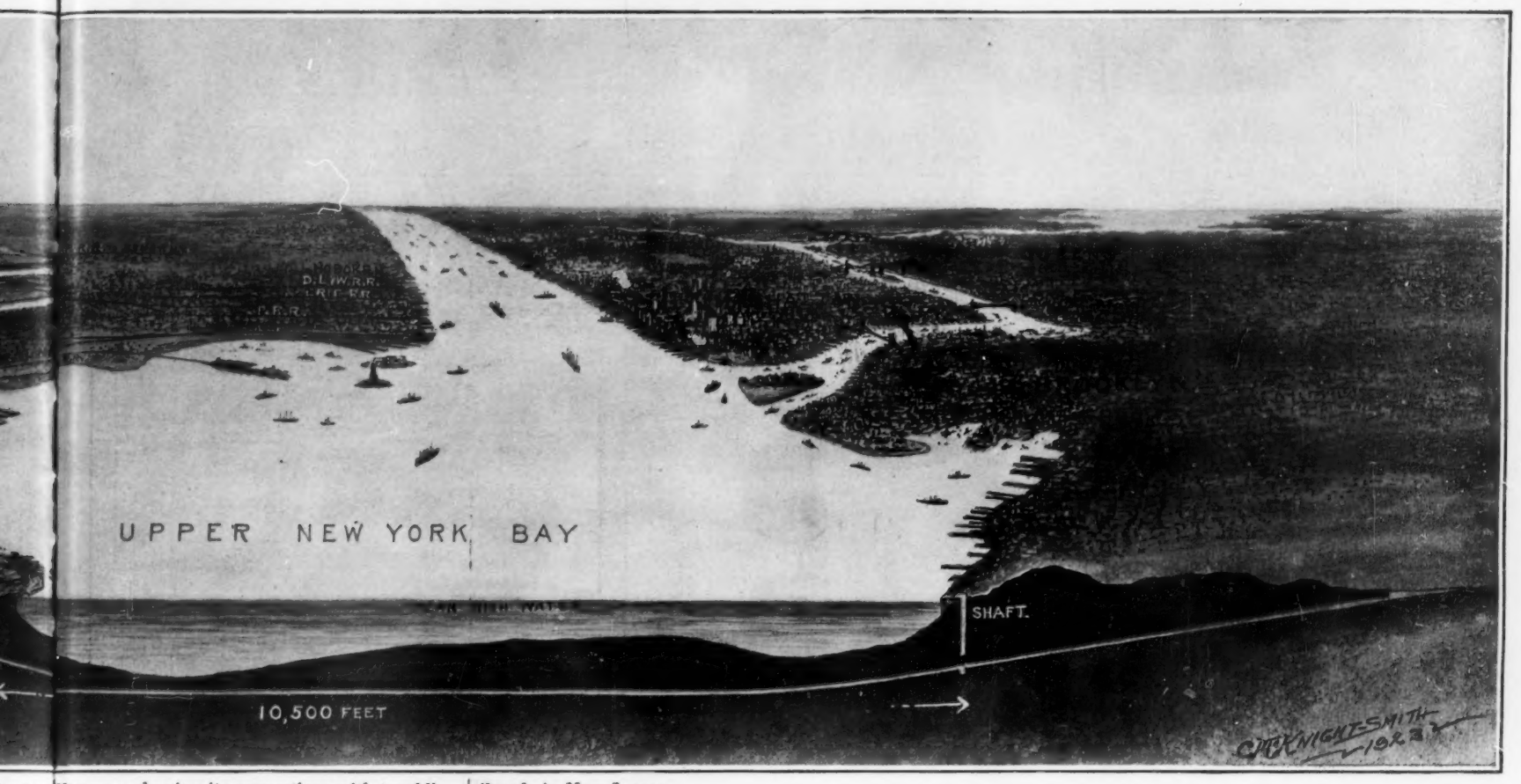
The distance between the shafts on each side of the Narrows will be 10,500 feet, the greater part of which will be at level grade. The land tunnel will total about 18,500 feet and there will be 22,000 feet of surface railroad, the total length of the line being, as we have stated, about ten miles. The estimated total cost of the line, as now planned, is about $60,000,000.

It is the expectation of the projectors that this important work will ultimately form part of a great belt-line system, which will start from the banks of the Hudson River in the northerly limits of the metropolitan area, and swing around the westerly outskirts of the district at a distance, more or less, of twenty miles from the Jersey City terminals of the transcontinental railroads, until it intersects the Baltimore & Ohio Railroad near Staten Island. Its connection, at its easterly end, with the Long Island Railroad will complete the circuit, and thus provide the metropolitan district with an exterior belt line, intersecting all the railroad systems which enter New York, and making it possible to transfer freight at the various points of intersection and carry it directly to the steamship, factory and warehouse to which it is consigned, without any breaking of bulk or any intermediate handling. One important advantage of such a belt line would be to get rid of a great part of the present cumbersome and costly method of transporting freight by means of steam lighters and barges. In view of the fact that over one-half of the foreign trade of the United States passes through the Port of New York, and that after a carload of freight from the interior has reached Jersey City, it costs something like two one-half dollars per car to get it to the consumer, it be understood that there is urgent need for making a tic change in our terminal facilities at this city and As a matter of fact, it costs as much to transfer mer dise from the Jersey City Terminal to the consignee does to haul it from five hundred to seven hundred overland.

The importance of the new tunnel, however, is fu enhanced by the fact that it will put Staten Islan direct rapid transit communication with Brooklyn, hattan and New Jersey. Of all the great boroughs which New York is divided, the Borough of Richmond been the most neglected as regards its transportation ities. The only means of access is by ferry, and this is not only slow, but is subject to serious delay d the prevalence of fog and of severe freezing weathe the winter. While the various suburban districts of York have been quickly built up as the result of the extension of our excellent system of subway and ele roads, Staten Island is as yet an undeveloped region, this in spite of the fact that its nearness to the se its diversified scenery render it ideal for subu residences.

As against a belt line built well back from Jersey and running through farm lands where the cost of necessary right of way would be moderate, the Authority favors the construction of a belt line wit mile or so of the Jersey City water front. This involve condemnation of expensive property and would to the railroad congestion which already exists to no extent in that territory, and although such a belt would be much shorter, it would not give such compre sive service as the one we have referred to above. believe that the Port Authority should think less in of the present and more in terms of the future. The belt line, which may seem remote to the present gener will not be remote in the next; so rapid is the growt our amazing city, a growth, by the way, which the struction of this tunnel and of an adequate belt line very greatly promote.

As to the structural features of the tunnel, there is division of opinion. There are those engineers who be




to pass Narrows, showing its connections with trunkline railroads in New Jersey

# rgubaqueous Tunnel

## Fred Passenger Tunnel Beneath Narrew York

ke two there is no system of construction superior to the use ner, it he shield and the building of a cast iron tube lined ing a concrete. This system has the advantage that it has y and thoroughly tried out, and that all the existing tunnels r nere th the North River and the East River are of this signee Tubes driven by the use of the shield can go where dred wish. They are very strong and stiff; and the experi- of many years has shown, once they are built, they is fu not subject to any displacement, or to any heavy bend- Islan stresses that would tend to produce fractures.

klyn. On the other hand, there are those who advocate build- oughs the tunnel by what may be called the "open cut" or hmond h method. In this type, of which we show a cross ation on, the tunnel is built without the use of any shield. this se first operation is to dredge a trench at the bottom of lay du iver or channel in which the tunnel is to be built, wide weathe gh to take the two tubes. The next step is to lower the ets of structures into the trench, in lengths of about two- f the red-and-fifty feet. This steelwork consists of two cir- d elev tubes built of three-eighth-inch shell plating, stiffened egion, carried at every twelve feet by steel diaphragms of e sea eighth-inch plate. Our cross section of one of the subu l openings shows that this diaphragm is rectangular tline, with stiffening angles extending from the out- ersey of the tube plate to the outer edges of the diaphragm. ost of ould be mentioned that piling is driven in the bottom the e trench to receive the ends of the tube sections after e with arious lengths of the steelwork have been laid and This w ected up. The whole mass is embedded in concrete, de- would ed under water from concrete-mixing barges at the to no lace. When this has been done, the structure, it will belt ben, consists of a monolithic concrete mass, with two compre el tubes passing through its center. The integrity of bove, ubes is further protected by lining them inside with s in t ete, as shown in our illustration. Bids may be put The o either the shield or the trench system of construction. gener

### Permanent $500,000 Fund for Scientific Research

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re is s used as the Society sees fit in the furtherance of ho bel ific research. Sir Alfred Yarrow, the donor of the fund, believes that the future prosperity of England depends upon scientific research done in the present. Believing that the Society itself is the best judge of the sort of work to be accomplished, he has made no narrow specification of the use to be made of it although he believes that the adequate payment of scientific workers and the provision for them of necessary apparatus is more important than the erection of costly buildings. The rules for the administration of the fund are to be revised at least every ten years.

### The Earth's Electric and Magnetic Fields

QUITE apart from those more spectacular manifestations of atmospheric electric phenomena associated with the thunderstorm, we have to recognize the following facts, as pertaining to the ordinary quiet day:

The earth is charged negatively to such an extent as to give rise to a vertical potential gradient which amounts to about 150 volts per meter at the surface of the earth, and goes through fairly regular variations throughout the day and throughout the year, variations amounting to 50 per cent, or more in its total value.

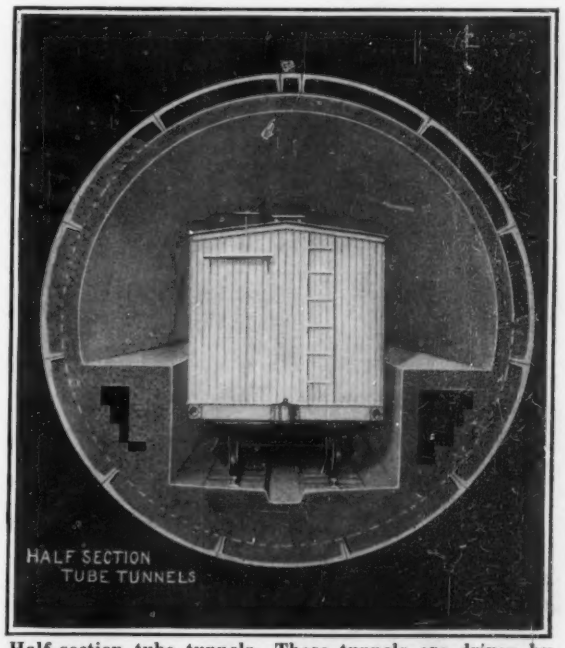
The potential gradient diminishes with altitude until its value at 10 kilometers is practically negligible compared with that at the earth's surface, a result which is brought about by the existence, in the atmosphere, of a positive charge, the total amount of which below the altitude 10 kilometers is practically equal to the negative charge on the earth's surface.

The atmosphere is a conductor of electricity. The conductivity near the earth's surface is so small that a column of the air one inch long offers as much resistance to the flow of the electric current as would a copper cable of equal cross section extending to the star Arcturus and back twenty times over.

In spite of the smallness of the conductivity of the atmosphere at the earth's surface, its amount is nevertheless sufficient to ensure that 90 per cent of the earth's charge would disappear in ten minutes if there were no means of replenishing the loss.

The conductivity increases with altitude at such a rate that its value at an altitude of 10 kilometers is about fifty times that at the earth's surface, and there is indirect evidence to substantiate the belief that at altitudes of the order of 100 kilometers it may attain a value more than $10^{21}$ times that at the earth's surface. Such a conductivity would cause the upper atmosphere to act, practically, as a perfect conductor in its relation to phenomena in the lower atmosphere.

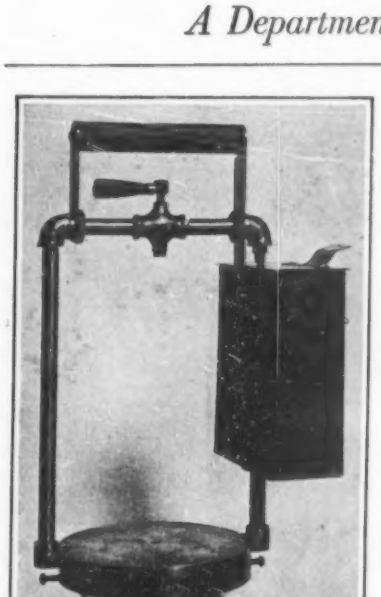
A potent factor contributing to the conductivity of the atmosphere is the radioactive material in the air and soil. There are, on the average, about 1.5 molecules of radium emanation per cubic centimeter of the atmosphere over land, yet this small amount is sufficient to contribute very appreciably to the ionisation there. On the basis of the known amounts of radium and thorium emanations in the atmosphere, and of radioactive materials in the soil, we could account fairly well for the ionisation of the lower atmosphere. The conductivity of the air over the great oceans is, however, practically as great as it is over land, and is very much greater than can be accounted for by the radioactive materials, which are negligible in amount in the ocean and in the air over it. The assumption of a penetrating radiation would provide a cause for the ionisation known to exist over the sea. If, however, we are unwilling to admit the existence of such a radiation, the ionisation over the ocean remains to some extent a mystery, and may have to be attributed to a small spontaneous ionisation of the gas.—*From recent lecture before Franklin Institute by Prof. W. F. G. Swan, Univ. of Minnesota.*




**Half-section tube tunnels. These tunnels are driven by the shield method and consist of cast segments bolted together, the interior being lined with concrete**

# Inventions New and Interesting

*A Department Devoted to Pioneer Work in the Various Arts and to Patent News*



**An automatic coffee dripper**

### Drip Coffee by Machine

AN automatic coffee dripper, to make real French coffee, that does away with the laborious process of pouring a teaspoon of water at a time into the pot, has been invented by A. M. Lockett, wholesale machinery man, of New Orleans. The construction and principle are shown in the picture. Cold water is placed in the reservoir at the right. The water passes through the pipe to the hollow base, which is heated by electricity, or can be placed upon an ordinary stove. As the water boils, it rises in the pipe on the other side and sprays out through the nozzle at the top upon the coffee in an ordinary French drip coffee pot. A stop valve prevents the hot water from rising into the reservoir. A small pipe exhausting through the reservoir and into the large pipe leading to the heating chamber takes care of the expansion when the nozzle opening isn't large enough to exhaust the full rush of boiling water and steam.

### The T-Square that Stays Put

A NEW combination drafting instrument uses a suction cup for holding it to any surface it is placed upon. The cup is inflated by pushing on the knob of the handle, as illustrated. It will hold the instrument to the board from ten to fifteen minutes. The cup can be turned out of the way when not in use. The instrument combines a protractor, rule and T-square. All angles are quickly registered by operating the instrument around the pivot point which is the suction cup. The holes in the rule are for chalk points, and are placed every inch for describing circles.

**Suction-cup attachment for holding drawing instrument to the board**

### A New Method for Determining the Rate of Sulfation of Storage Battery Plates

STORAGE batteries have recently come into very extensive use particularly in connection with automobiles, and anything dealing with the proper method of caring for such batteries is, therefore, of considerable general interest. The life and efficiency of storage batteries depend upon the purity of the materials used in constructing the plates and on the purity of the electrolyte. But little exact information is available on the effect of impurities in the solution which serves as the electrolyte, and the methods ordinarily employed for determing the effect of such impurities are time-consuming and often inaccurate.

A new method has been devised by the Bureau of Standards for measuring the rate of sulfation of the plates resulting from local action. This method is rapid and accurate, but requires some special apparatus. By this method a study has been made of the rate of sulfation of both positive and negative plates in solutions of varying concentration. The results are described in Technologic Paper No. 225 of the Bureau of Standards which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents a copy. This paper covers the first step in a more extended investigation of the effect of impurities.

### Discussion of Logging and Safety Code

THE Bureau of Standards has prepared a discussion of the recently adopted safety code governing logging and sawmill operations. This discussion is intended to explain why certain provisions are included, and also, in some instances, to give further details concerning methods of safe operation. It will be recognized that this is in line with the discussions published on the National Electrical Safety Code, known as Handbook No. 4 of the Bureau of Standards, and the discussion of the Head and Eye Code, entitled Handbook No. 2 of the Bureau of Standards. The discussion will be illustrated by photographs taken in the field by the Bureau's engineers, by the United States Forest Service, and various State commissions.

One interesting item in this discussion is the description of the V-notch method of felling trees. This was worked out by the Southern Pine Association for the purpose of preventing ""kick-backs" of the butt of the log as the tree fell. Not only was this method successful in preventing such "kick-backs," but when put in practice it was found that it gave larger yields of sound timber than the old method of making a horizontal cut. A reproduction of the poster published by the Southern Pine Association is given in connection with the description of this method.

### Micrometer and Snap Gage in One

AN automatic, spring-driven measuring machine, controlled by contact with the object being measured, combines the functions of the hand micrometer and the limit snap gage. It is an automatic micrometer having an operating range of .050 inches, an adjustable range of one-half inch and an interchangeable tolerance segment on the index arm. It is automatically centered and squared on the work. The micrometer spindle is automatically released, automatically set to a definite pressure, and automatically locked to retain the reading as the instrument is withdrawn. It follows up successive reductions and is set back by hand to receive the next piece.

The automatic action eliminates all need of skill or training in its use. There are no micrometer scales to be read and interpreted. There is no reading to be remembered, drawing size to be subtracted or calculation to be made, and no numerical tolerances to be considered. For production use it is adjusted to read zero at the finish size. It then reads directly on its dial the amount that the work is yet to be reduced. The reading is automatically retained and the machine tool may be accurately set for the next reduction or the finish cut. There is no guesswork or time lost in working down to size. The operator gives all his undivided attention to the efficient reduction of the work within the acceptable precision, as graphically shown on the tolerance plate.

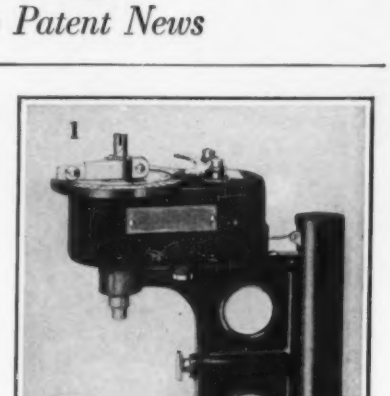
A measurement takes only two seconds with one hand. It can be taken in any position and from any direction, as there is no mechanism to be manipulated and the dial need not be in view. The dial is large, the scale open, the lines and figures distinct, and the zero in the same central position for all adjustments.

It is always adjusted and used to the index line, representing the exactly correct size of the product. The user aims at the correct size and produces a substantially correct average size, while the tolerances are employed as the occasional extreme deviation conceded in the interest of rapid and cheap production.

### Method for Making the Interior of Automobiles More Comfortable in Hot Weather

ATTENTION has been called previously to a simple means for decreasing the heat radiated through a tent or other light covering which is exposed to the sun. By coating the under side of the tent cloth with aluminum paint, the heat radiated from the under side is reduced by 85 per cent. Painting the outside with aluminum paint was found to be slightly less efficient, the heat radiated from the under side being reduced only about 80 per cent.

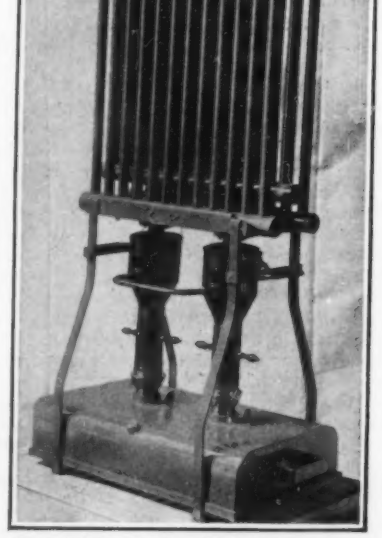
Coverings of conveyances, such as, for example, the tops of automobiles, ice wagons, etc., consist of cloth, the outside of which is often painted with a black composition which absorbs perhaps 90 per cent of the sun's rays. Practically half of this is reradiated from the under side of the cloth. Tests are in progress at the Bureau of Standards which show that a coating of aluminum paint applied either to the outside or inside of such tops reduces by 50 to 60 per cent the intensity of the heat radiated from the under side into the interior of the conveyance.



**The automatic micrometer, that discharges also the functions of a limit snap gage**

### The Individual Radiator

HERETOFORE, in heating a single room that has no connection with a central heating plant for the entire house, it has been necessary to use a stove of some sort, radiating its heat directly into the atmosphere of the room. Whether the stove be a wood, coal or oil burner, whether it be used with or without a pan of water to maintain the proper degree of moisture content in the room, there are serious drawbacks to this procedure. These seem to be avoided in the individual radiator which we illustrate herewith. The bottom tank of gasoline feeds the two burners, in much the same way as with the conventional gasoline or kerosene water heater. These burners heat the air in the smaller cylindrical chambers above them, and the hot air heats water in the larger cylindrical compartments just below the radiator. A thermo-siphonic circulation is set up through the radiator, and the latter radiates heat to the room just as does the radiator of the conventional hot water heating system. The radiator tubes are



**The independent radiator for rooms that have no connection with a central heating plant**

Clearing the kitchen drain without sending for the plumber

of copper. Fuel and water for a week's operation, it is claimed, are supplied at a single charging of the tanks. The apparatus is recommended, and is obviously of value, for isolated rooms and unheated apartments.

## Accuracy of Analytical Weights

AN instance of sustained accuracy in the weights which are now being submitted to the Bureau of Standards for test was noticed during the past month. In a shipment of nine sets, containing a total of 216 weights, all were within the required accuracy. Only once before has a larger number of sets been submitted without some of the weights having errors greater than the prescribed tolerances. The fact that such shipments are now received, even if only occasionally, is an encouraging indication of the good work done by some American makers. It need not be said that such sustained accuracy would have been entirely out of the question as recently as ten years ago.

## The Renewable Eraser

THE consumption of circular erasers in the ordinary office is very heavy, and these handy little correctors constitute no small percentage of the stationery bill. The metal holder and the brush (if the brush type be used) cost the manufacturer more than the abrasive business section, and, with this fact in mind, a Pittsburgh concern has put out a model designed to save these portions of the eraser ensemble from the waste basket. A new eraser goes into the old holder, just as a new pen goes in the old penholder. All that is necessary is to loosen the screw, make the substitution and replace the screw. We don't throw away penholders or drill handles; why throw away eraser handles?

The plow that uses the explosive force of the exhaust gases of the propelling engine, to disrupt the soil

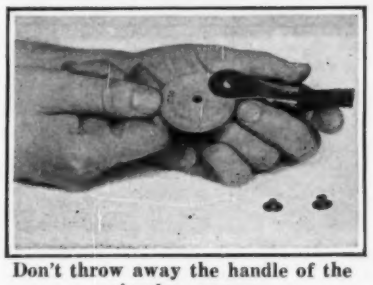
## The Home Plumber

IN the best regulated families, coffee grounds and grease get into the drain of the kitchen sink and check or stop entirely the flow of water. The handy little aid to good housekeeping shown in the accompanying photograph steals a few plums from the plumber and enables the mistress of the house to clear out the pipes herself. It is used, as shown, with a little water in the basin of the sink. It works through hydraulic pressure, and is powerful enough to force down into the trap almost any accumulation that may be in the pipe.

## Medicine to Breathe

PHYSICIANS often prescribe the inhaling of medicated vapors in treating coughs and other disturbances of the chest cavity, the nose and the throat. But a proper and continuous supply of the vapor, of uniform concentration, has not been easy to obtain. The croup kettles, steam atomizers and inhalers offered have been but halfway measures, lacking the proper efficiency.

A very clever invention has, according to the claims made for it, solved the problem. The idea is that of the old-fashioned lamp wick, but the wick does not carry the fuel. It carries, instead, the medicated liquid which it is desired to vaporize for the patient to breathe. It draws this from a reservoir, just as the lamp wick draws its oil. The wick in the radiodor, as the apparatus is called, however, passes over the surface of an electric light globe of a type whose luminous efficiency is rather low, and which therefore develops more heat than would be desirable if it were being used as a source of light. With the wick carrying the medicated liquid in minute but uniform quantities to the large, evenly heated surface of the globe, the fluid vaporizes at once and at a constant rate, and the patient is assured of exactly the atmosphere which has been prescribed for him. A larger and more elaborate model than the original one just described passes the medicated vapor through a water-soaked gauze cylinder, reaching the patient only after this filtering, and giving double assurance of a water vapor continuously and evenly medicated.



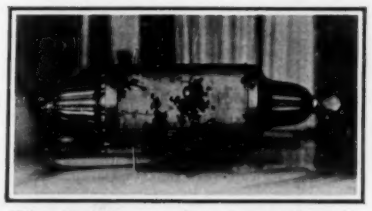
Don't throw away the handle of the circular eraser

## The Exploding Plow

SOMETHING new in plows is being marketed, based upon patents issued to Herbert Knight of New York. Instead of simply turning the ground over, the new implement shatters it, the pulverizing being accomplished by a series of explosions that takes place below the surface. The plow is propelled by a gasoline motor, the exhaust gases from which are conveyed through a suitable pipe into hollow cultivator teeth which extend into the soil. The lower ends of these teeth have suitable openings, through which the gases discharge with detonating force. The ground is thoroughly broken, the weeds torn out, and the earth left in a fluffy and highly aerated state. The detonating gases are mainly carbon dioxide, water vapor, oxygen and nitrogen, all beneficial to plant growth. The force of the explosions destroys fungi, undesirable animal life, eggs and larvae.

## Convenience for the Smoker

A VERY complete and handy match box holder has recently been invented by E. R. Ganson of Columbus, Ohio. It is manufactured in two sizes: the smaller for safety matches and the larger, as illustrated, for double-tip matches. Both sizes have fireproof receptacles of ample size for the reception of burnt matches, as well as fireproof ash trays. Both are adapted for mounting upon any vertical, horizontal or inclined surface, or to set loosely upon a horizontal surface such as the top of a cigar case or counter. The small size is admirably suited for mounting upon the instrument board or windshield of an automobile. An empty box can be removed from the holder and a full box substituted in less time than it takes to tell about it. The match box itself is held securely in the most convenient half-open position, and does not have to be broken out at one end to facilitate the removal of matches. Both holders are made of sheet metal.



The electric vaporizer for medicated vapors

## Methods of Measuring the Properties of Electrical Insulating Materials

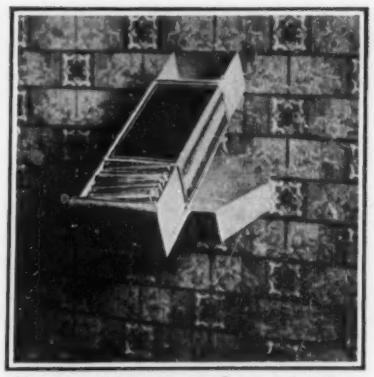
SCIENTIFIC Paper No. 471 of the Bureau of Standards, which can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents a copy, describes methods of measuring the properties of electrical insulating materials. This paper gives a series of electrical, thermal, chemical and mechanical test methods which have been found useful in the study of solid electrical insulating materials. The several tests described are those used in obtaining the data previously reported in Technologic Paper No. 216 of the Bureau of Standards entitled "Properties of Electrical Insulating Materials of the Laminated Phenol-Methylene Type." The several test methods described are radio-frequency phase difference or power loss, dielectric constant and flashover voltage, direct-current surface resistivity and volume resistivity, tensile strength, modulus of elasticity (tensile), proportional limit, modulus of rupture, modulus of elasticity (transverse), Brinell hardness, scleroscope hardness, resistance to impact, permanent distortion, density, moisture absorption, machining qualities, thermal expansivity, and the effects of heat, acid and alkali.

The methods and apparatus are described in some detail: first, so that the data in Technologic Paper No. 216 will be definite and be capable of being correctly compared with other data; second, so that any of the tests may be reproduced by others.

## Tests of Radio Receiving Sets

THE results of tests of radio receiving sets by the Bureau of Standards are given in a series of Letter Circulars, the first one of which (No. 90) was issued a few weeks ago. This paper dealt with tests of electron tube sets. The second circular of this series (No. 93) is now ready for distribution and gives the results of tests on crystal detector sets.

It is believed that the methods followed and the examples given in these reports will be of assistance to manufacturers in the development of methods of testing besides aiding them to properly describe and improve their products. The particular receiving sets are referred to by arbitrary reference numbers rather than by manufacturer's name and type and model numbers. As these circulars are available only in mimeographed form, the supply is limited; but copies can be obtained by those directly concerned with the testing of receiving sets by addressing request to the Bureau of Standards.

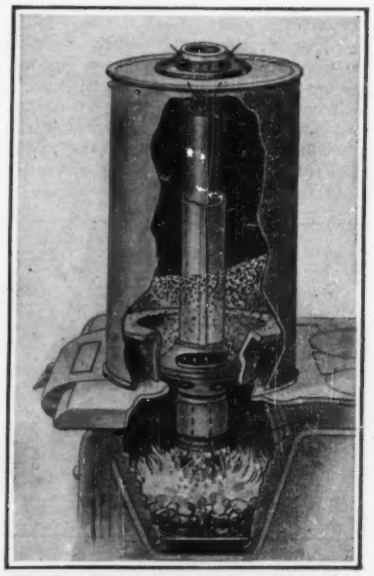


Fresh and burnt matches and ashes are all taken care of by this holder

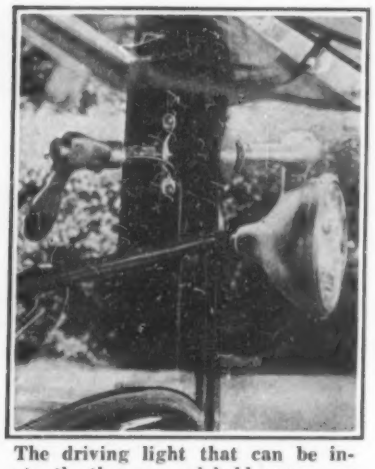
## An Indoor Draft for the Kitchen Range

WITH the apparatus of the accompanying drawing, one of the ordinary stove holes in the top of the kitchen range may be used to secure an improved draft and a hotter fire. The "hot blast feeder," as its inventor calls it, takes the place of the stove lid, and he emphasizes that it doesn't occupy any more space than a cooking kettle, and is more ornamental.

The idea of the hot blast is to have an extremely hot nucleus in the fire, immediately below the discharge point of the apparatus. The fashion in which it achieves this is self-explanatory. An additional function may be got from it when slack or powdered coal is burned. The cylinder of the blast outfit, around the draft tube, may be filled with such material, and will act as an automatic auxiliary feeder, insuring a continual supply of highly combustible fuel at the hot spot of the fire. This does not, of course, replace hand stoking of the stove entirely; it is simply an auxiliary arrangement, looking toward making the hot focal point of the fire even hotter than it would be possible to have it with the blast alone.



The hot blast device for making the kitchen fire hotter



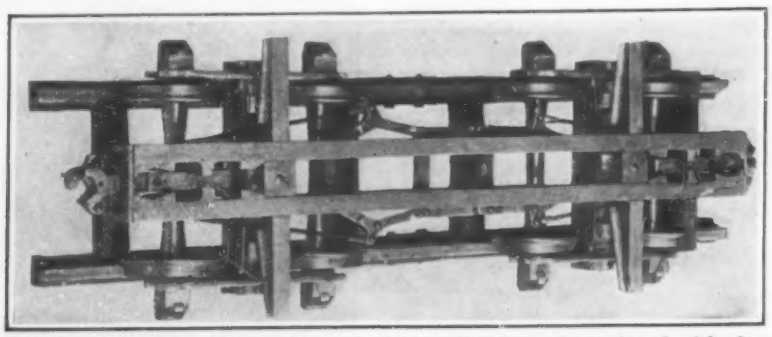
The driving light that can be instantly thrown, and held, upon any point of the road or the surrounding country

## The Light that Shines Where It is Needed

FOR open or closed cars, the driving light which we illustrate gives a certainty of performance and an ease of operation which, the manufacturer says, can only be appreciated through actual use. The light is instantly rotatable to any point on a sphere, and will remain fixed in any position on the roughest road. The means for thus moving it is the control handle which is seen projecting from the frame of the car toward the driver. The slightest touch upon this handle changes the light from its normal position of straight ahead, to the ditch, giving perfect illumination for the driver at the point where he needs it most in passing, while at the same time extending to the approaching car absolute freedom from glare. The electric switch is at the base of the control handle, in such a position that the thumb rests naturally upon it in grasping the handle, permitting a quickness of turning on and off never before attained. It gives a combination of the spotlight and the driving light which should be of the greatest value to all who are obliged to drive extensively at night.

## Smooth Starting for Steam Trains

DETAILED description of the improvement in railroad couplings patented by Mr. E. W. Brown of Lancaster, Pa., would be out of place save in a railroad magazine, but a statement of what it does and in a general way how it does it should be of general interest. Everybody who ever rides on a steam train knows how the cars bump and jerk in starting, while the slack in the couplings is being taken up, and how the entire train heaves and buckles as each coupling straightens out, takes up its load, and gives the first yank to the car behind it. Mr. Brown would equip our cars with central longitudinal girders or frames, running from coupler to coupler. These frames would have a certain amount of play under the car, for which the inventor has made ingenious provision. When the engine gives its first forward impulse, the first coupling would go with it, as always, but instead of bringing the first car along, this would merely move the sliding girder-frame forward sufficiently to take up the slack of the second coupling. With this coupling in play, the same thing would happen under the next car, and the next, and the next, and none of the cars would tend to move forward at all until all the couplings were taut. Then the rear car would get the pull, would have no car behind to which to transfer it, and would start to roll forward, bringing the entire train into motion without jars or jerks.



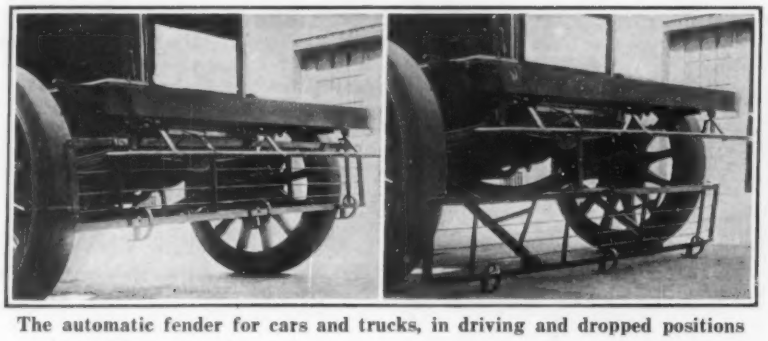
Looking down upon the running gear of a railroad coach, equipped with the apparatus that allows the couplings of successive cars to play against one another until the slack is taken up, so that the train may start without jerking

## A Novel Demonstration

AN automobile's lubrication, in some measure at least, depends upon gravity to make the oil flow over the lubricated surfaces, and this is true of cars having the most elaborate force-feed oiling, in only less measure than of those relying upon the simple splash. So when a prospective purchaser lives in mountain country, it is a pertinent question for him to ask what effect continual running on heavy grades is going to have on the lubrication system of his car.

A San Francisco agent for one of the popular lighter sixes recently staged a very clever demonstration covering this ground. As our illustration shows, he built a false bottom under the front end of his car, of such height as to tilt the machine to an angle of 32 degrees. With a steering gear that had been sufficiently tampered with to make the feat possible, he drove this fearfully up-tilted car for many days and many miles through the streets of San Francisco and Oakland, always under its own power. The complete failure of the oiling system to give the slightest trouble under this severe test is offered as proof positive that the car will get oil wherever it can go in California's mountains.

To prove that the oiling system would function under the severest handicaps, this demonstration car was run under its own power in the condition shown



The automatic fender for cars and trucks, in driving and dropped positions

## An Automatic Safety Fender

IT has long been contended that the high total of deaths resulting from persons' being struck by automobiles and trucks could be materially decreased by the invention of some sort of fender which would keep the victim of the accident from rolling under the wheels of the vehicle. In nearly every instance where death has occurred as a result of accidents of this nature it has been due to the fact that the person struck has been run over by the wheels before the vehicle could be brought to a stop.

A countless number of safety devices has been developed that claimed to work to this end. A recent one is of unusually simple construction, consisting of a bumper, a horizontal trip bar and an automatic fender. The trip bar is located an inch or two in front of the fender when driving, and the instant the person is struck it releases the fender, which drops to the ground and, by pushing him along in front of them, prevents the person's being crushed beneath the wheels. It is said to be impossible for the victim to get beneath the wheels of the vehicle, and the most extensive tests have served to bear out this contention, the fender never failing to operate.

When a body is struck the fender automatically releases and drops to the ground, thus pushing the body ahead of the truck and making it impossible for it to get beneath the wheels of the vehicle. The driver has his hands free to stop the vehicle, is not required to lift a finger to operate the fender and need pay no attention to it whatever, because, as the name implies, it is actually automatic in its operation.

To the thousands of car and truck drivers throughout the country who do a large amount of driving and who are always a bit nervous as to the possibilities of accidentally running into a pedestrian, this invention should be very attractive.

## A Means for Increasing the Efficiency of Radiators

IN the last issue of the SCIENTIFIC AMERICAN, mention was made of tests in progress at the Bureau of Standards on the emissivity of sheet iron covered with white paint, glass enamel, aluminum paint, etc. These tests are of interest in connection with the question of heat radiated from the under side of roofing material, etc., when exposed to the sun. Data were given showing that a coating of aluminum paint emitted only 27 to 30 per cent as much as white paint, glass enamel, or other nonmetallic surfaces.

The application of this information to the painting of radiators for heating houses is obvious. But the gain in heating, by covering the surface with a nonmetallic paint, is not two to three times that of the aluminum paint, as might be inferred from the above-mentioned data. This is owing to the fact that an ordinary steam radiator is cellular in structure, which facilitates heating of the air by conduction and convection. The heat radiated from the sides is relatively of secondary importance.

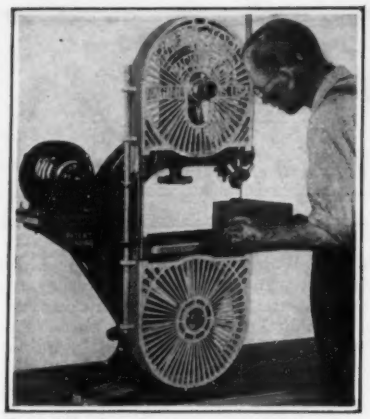
Previous publications on this subject (Allen, *Electrical World*, 57, p. 1616, June 22, 1911, and *Jour. Am. Soc. Heating and Ventil. Eng.*, 26, p. 305, 1920) indicate that a radiator coated with aluminum paint emits only about 80 per cent as much as a radiator which is enameled or covered with a nonmetallic paint.

In other words, we may expect a gain of 15 to 20 per cent in heat dissipation by using a nonmetallic covering on ordinary house radiators. This is worth considering. The nonmetallic coating can be painted over the aluminum paint (if the radiator happens to have a coat of aluminum) which is a good conductor of heat and hence does not impede thermal conduction through the walls of the radiator.

## The Talking Glove

THE curious glove which we illustrate herewith has two uses. The letters are marked upon it in the positions of one of the standard alphabets wherewith deaf-and-dumb people talk among themselves with such incredible speed. One learning the alphabet and its use may wear the glove for guidance until he acquires facility; and one who does not

For learning the deaf-and-dumb alphabet, or using it without learning it



**Portable band saw specifically designed to work with either wood or metal**

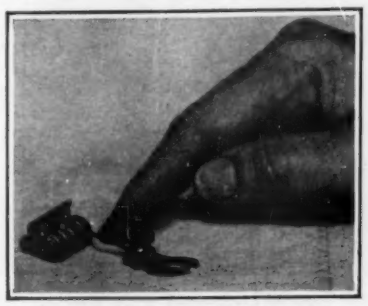
expect to learn it, but who must talk with a deaf-and-dumb person, may use it as a guide for his own speech and a means of translation of what is said to him. The letters are arranged, it will be noted, in a manner not entirely dissimilar to the universal typewriter keyboard.

## A Simple Luggage Carrier

AN unusually effective luggage carrier has just been put out from North Tonawanda, N. Y. As our photograph indicates, without making the *modus operandi* exactly clear, the new carrier provides means for strapping with the utmost security to the running board anything of such size that the running board will carry it. The means of accomplishing this consists in the main of a metal strip, extending across the running board from the inside to the outside edge. At the inside edge it is securely bolted to the running board by means of a long bolt and a wing-nut. At the outside, the weight of the luggage which it carries holds it down. All along this strip there are oblong holes, into any of which the outer strap snaps with a snaffle hook. The inner strap snaps similarly into the upper end of the bolt member. The two straps are then brought around over the baggage, drawn as taut as may be, and buckled together. Photographs are shown us of a full-sized steamer trunk carried in this way for 8,000 miles, a suitcase carried 6,000 miles on end, to leave the door clear, and an outfit of baggage and camp equipment in nine pieces carried over 3,000 miles. In the latter case, four of the units were employed; with single pieces of baggage two seem always plenty. In any case, as many may be mounted as the exigencies of the situation demand, and the baggage is carried with complete security because, in the words of the manufacturer, it becomes for the time part of the car.

## Each Coil a New Fuse

SOMETHING new in the way of renewable fuses has just been put out, and is illustrated herewith. The six coils of wire in the device represent six fuses, any one of which is immediately ready for connecting to the terminal after it has been straightened out. These coils are of standard fuse composition. We show the fuse with one coil straightened out and attached to the binding post, and the others waiting to be used in turn.



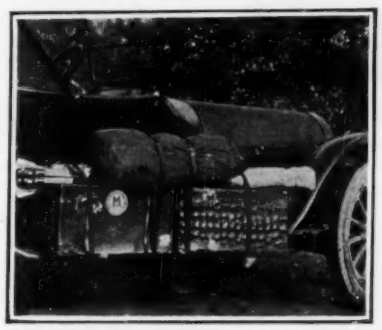
**The newest renewable fuse outfit**

## The All-Around Band Saw

AMONG the season's novelties in the tool industry is a portable band saw for cutting wood and metal, put out by a Wisconsin manufacturer. It is claimed to be the only portable metal-cutting band saw on the market, and the only one that is specially designed for cutting both wood and metal. The illustration gives a good idea of the general character of this saw. Special features worthy of mention include ball bearings for the saw wheels, with upper wheel adjustable by sensitive hand-screw to insure perfect alinement. Tension on the saw-blade is controlled by another hand-screw, which works against a spring in such a way as to obtain uniform and cushioned tension. Incidentally, when chips and blocks fall between the saw and the wheel, this spring insures that they pass harmlessly around the wheel, without breaking the saw-blade. The very efficient guard members swing outward on a hinge, opening the wheels and the running blade to inspection and adjustment. For shaping jobs of all sorts in wood, steel, iron, aluminum, brass, fiber and hard rubber, the makers recommend the machine without reserve.

## Spring Hangers That Are Different

ONE of the points where Tin Lizzie comes in for much abuse—both verbal and operating—is the front spring shackles. It almost seems as though the average driver had no realization at all of the fact that the weight of the entire front half of his car is suspended from the springs by these four little members. But whether he be inclined to do his duty by the shackles or to shirk it, he ought to find greater riding comfort with the suspension illustrated. This, it will be observed, substitutes for the single pair of shackles at each end of the spring a duplex effect, and it has a little auxiliary spring between the two points at



**Making the baggage part of the car**

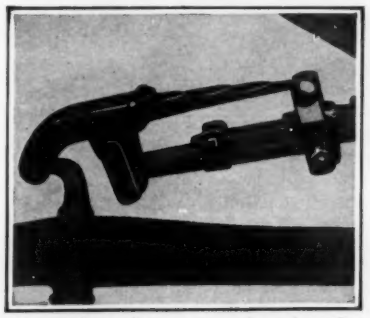
which suspension is effected. The result is claimed to be a vastly better cushioning; and it certainly looks plausible.

## New Use for Mouse Traps

ACCORDING to the United States Department of Agriculture, the mouse trap has a new Government job. Finding English sparrows, which have been committing serious depredations on the immature corn and mungo beans growing in the experimental plats of the Federal experiment station at Honolulu, Hawaii, too wary to eat poisoned grain, the mouse trap was called into service. In the corn plats, the traps are wired to partly-eaten ears. For bait a soft kernel is used. When the bird attempts to eat the innocent-looking bait, the trigger is released and the pilferer caught by the head or neck. Death is instantaneous. For the mungo beans, the traps are also baited with soft corn and laid on the ground near the plants.

## The Latest Stream-Lined Car

FROM Berlin, the home of the stream-lined automobile, there comes forth every now and then a brand new shape in which this idea is worked out in a different fashion. The very latest example looks a good deal like the domicile of the old woman who lived in a shoe, until one gets the proper mental and optical slant upon it to realize that it is really an automobile. In keeping with modern doctrine that the stream-lining of the rear is of more vital importance than that of the front, the long wedge-shaped profile presented by this car is the stern; the prow is comparatively blunt. The wheels seem to be of the conventional disk pattern, apparently with no attempt to stream-line their profile, which might seem a fatal omission. Our photographer assures us, however, that the weird vehicle has great speed—and, of course, that it "has taken years to perfect."



**A novel spring suspension for the front system of the flivver**

## How Strong Are Hollow-Tile Walls?

IN a series of tests made by the Bureau of Standards in a 10,000,000-pound hydraulic testing machine, and described in Technological Paper No. 238 of that bureau, walls made of common fireclay tiles twelve inches long, twelve inches wide and either six, eight or twelve inches thick were tested to the point of failure. These tiles were first tested individually and their strength was found to be much greater than that of those usually used in building construction. Their design was such that all the net area was in bearing when carefully set on end in the wall. Owing to the fact that the walls were very carefully set by an experienced mason they are considered to have been stronger than those usually used in buildings.

Of the thirty-two walls which were tested about half were built with the cells of the tile vertical and the other half with them horizontal. A few walls of each construction were tested under an eccentric load two inches off center.

It was found that considerable differences in the strength of the tile did not have an appreciable effect on the strength of the walls. No relation was found between the ultimate strength and the load at first crack. Walls having the cells of the tile vertical had, on the average, more than twice the strength of those having the cells horizontal. Walls loaded with an eccentricity of two inches had about one-half the strength of similar walls axially loaded. Apparently this ratio is independent of the thickness of the wall.

## An Electrically Lighted Gas Furnace in the Floor

AN electrically lighted, fully vented gas floor-furnace is now offered, in which the entire control and lighting apparatuts act as one. When the gas is turned full on, an electrical contact (low tension) is formed which gives a spark (high tension) in the plug. Lighting is thus positive and instant, without the use of pilot or matches. This should not be confused with the ordinary "electric

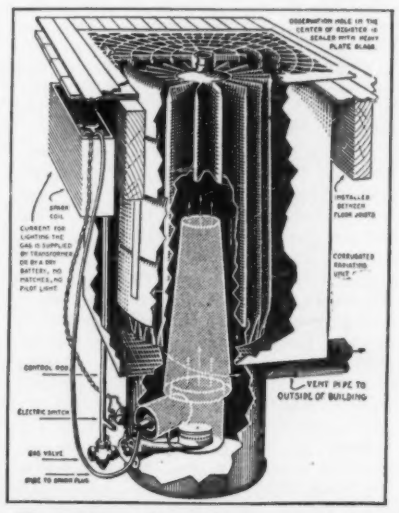
**Stream-lining in its latest form—not a shoe, an automobile**

push-button control" which consists of a magnet valve and requires a pilot light to be burning constantly.

The electric current is supplied by a four-cell dry battery and a standard spark coil. The spark plug is in a cast iron chamber and does not come in contact with the flame. If so desired, the battery may be eliminated by connecting the spark coil to a bell-ringing transformer of the proper size.

This gas furnace has many safety features. It has no dangerous pilot light, and the products of combustion are absolutely sealed from the room air, being drawn off through a concealed vent pipe. There is no danger from explosion, as the construction is such that it may be deliberately filled with gas and then ignited without harm or danger. This important feature is due to the entirely open design of base of the combustion chamber. The flame cannot be blown out by a down draught or back draught in the flue, as it burns within a cone-shaped combustion chamber, and is, therefore, isolated from any side draughts. The effects of a back draught are cared for by the small safety vent holes in the lower portion, just below the flue outlet. In event of back draught the "dead air seal" drops slightly, thus uncovering the safety vent holes and allowing the backed-up fumes to escape through them, without smothering the flame. Should the gas be turned on deliberately without lighting it, there is no danger of its entering the rooms. There is no danger of fire; the box, insulated with asbestos, may be placed snug against the wood joists without the least danger—the box remains cool on account of the cold air-intake space entirely surrounding the hot radiator. The furnace is so simple and fool-proof that a child can safely operate it.

The furnace is unusually economical in its operation—high efficiency being obtained by the method of passing the hot gases through wide, ribbon-like corrugations instead of the usual tubes.

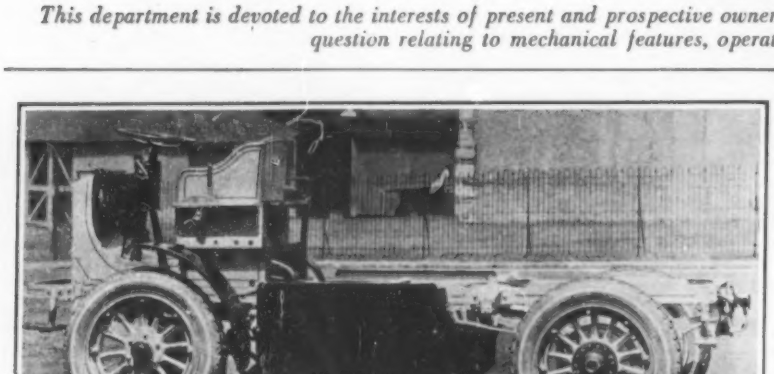



**The fool-proof gas furnace to be installed beneath the floor**

# The Motor-Driven Commercial Vehicle

Conducted by MAJOR VICTOR W. PAGE, M. S. A. E.

*This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles*



**New electric truck chassis, showing accessible carrying boxes for batteries, suspended on their own springs to reduce shock**

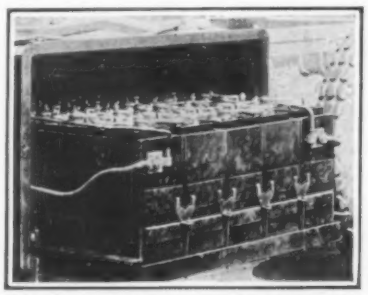
## Electric Truck with Novel Battery Suspension

AMONG the season's new offerings is an electric motor truck in which the construction has in numerous ways been simplified to promote ease of operation and accessibility of all of the important units. The chassis is designed as a complete unit, with no part of it depending on the body. The dash, fenders, seats, etc., are included in the chassis price. The electric driving motor is mounted under the seat. It is hung in a heavy cross member, which also serves as a support for the front end of the battery. The motor is connected to the rear axle through a three-joint propeller shaft, which is supported in the center by a self-aligning bearing.

The outstanding feature of the new truck is the battery suspension. A sliding tray is provided by means of which the battery trays are mounted in a single master tray, which is on rollers in the cradle, and can be moved, without auxiliary apparatus, into a position where all of the cells of the battery can be reached for flushing or other attention. It is unnecessary to break any electrical connections to do this work, and the door of the battery box serves as a lock for the sliding tray. Means are provided for stopping the tray at the end of its travel, but these stops are easily detached when it is necessary to remove the entire tray from the truck. Therefore, for complete replacement purposes, the battery can be removed easily in two sections and a fresh battery substituted. The trays and compartments will accommodate regular and oversize batteries for the various models. Any standard battery can be installed.

It is difficult to design a structure successfully to carry such a highly concentrated load as a battery. For convenience in manipulation and to make all of the car platform space available for pay load, this mass should be hung beneath the frame. Such a construction brings the center of gravity of the battery close to the ground. With this relationship, it is not possible for the conventional springs to function properly in cushioning the battery and frame against shocks, and the normal accelerations and retardations from a rough road set up heavy stresses, both in the battery and in its supporting frame. These stresses are multiplied many times when the truck backs up against a platform or curb. In the new electric this problem is relieved by swinging the battery cradle in links to permit movement in the direction of the motion of the car, and with this movement opposed by springs, quite distinct from the chassis springs, a construction is obtained which eliminates shocks due to this suspended weight.

The new electric truck is unusual in other respects, not the least of which is the fact that it is put out by a concern that has for years manufactured gasoline trucks. The load-carrying elements of the chassis are of the same design and construction which have been tested by years of successful operation of these gas-driven vehicles. It is possible to install a body with the platform close to the ground, so that the load can be handled easily. The chassis is designed as a complete unit, with no part of it depending on the body. Two brakes are provided, the ordinary service foot-brake, and a hand brake for emergencies and for holding the truck when at rest. It is also possible to reverse the motor for emergency braking—a feature unique to the electric truck.



**The battery tray moved out for inspection of the cells**

## A Self-Contained Kerosene Carburetor

THE fuel situation is more acute in England than it is in this country, as it is necessary to import the greater part of the fuel used in automobiles because there are no local sources of supply, if one is to except the shale derivatives and benzol, neither of which is produced in sufficient quantities to supply even a small part of the demand. For that reason, English truck designers continue their experiments with devices intended to burn lower grade fuels corresponding to what is sold in this country as kerosene.

A kerosene vaporizer operating on the partial combustion principle is used on certain trucks and was recently illustrated and described in our English contemporary, *Engineering*. The device is considerably smaller than other kerosene carburetors and is self-contained, that is, it does not require so-called hot-spot or exhaust-heated manifolds. The kerosene tank is connected to the carburetor intake, and is controlled by an ordinary carburetor float. From the float chamber the fuel travels into a passage in the body of the main casting, to which are connected a main jet and an auxiliary jet. The main jet terminates just above the level at which the float valve maintains the oil, but the fluid rises through the auxiliary jet into the bottom of a small secondary chamber. Fitting into the sides of this chamber is a casting, the bottom of which is pierced with a number of holes, each of which is filled by an asbestos wick. The lower ends of these wicks dip into the kerosene in the secondary chamber.

To start the engine from the dead cold condition, the carburetor cover is removed, by loosening the wing-nut which holds it, so that air has free access to the inside of the wick casting. A high-tension spark is then passed from the spark plug to a piece of metal surrounding the wick directly beneath the plug. This ignites the wicks, which are allowed to burn for a minute or so, to warm the casting. The cover is then replaced and the engine is ready to be started. The spark is again switched on and the engine cranked round. The operation of cranking draws air through a small plate, which is perforated with holes. This air is separated into two portions. One passes directly down through the curved pipe and upward past the end of the main fuel jet. This is the main vaporizing air which draws the kerosene out of the jet and carries it upward in the form of mixed vapor and spray.

The other portion of the air is led to an annular space surrounding the wick casting and passes into the interior of this casting through the numerous small holes drilled through its walls. The presence of this air keeps the wicks burning after they have been lighted by the spark. A small part of the heated products of combustion passes upward, mixing with the pure incoming air to raise its temperature. The major part, however, passes out at a very high temperature, meets the kerosene spray as it emerges from the jet and completes its vaporization.

A baffle above the jet assists the mixture and forces the vapor into contact with the walls at a point where they are maintained at a high temperature by the hot gas or flame surrounding them. The mixture, and the additional air required for combustion, are controlled by separate butterfly valves, so connected that a richer mixture is automatically provided when the engine is "idling," and the mixture strength may also be increased above the normal under overload conditions.

It is claimed that the engine can be started within a minute or so from cold, without the use of gasoline or any means of auxiliary heating. As soon as the engine is firing, the spark in the vaporizer is switched off, as the passage of air over the wicks is then sufficient to keep them alight. Should they be blown out by a backfire, or become extinguished from any other cause, they can be instantly reignited by switching on the carburetor spark momentarily. When the engine has been running long enough to heat the water in the radiator appreciably, it may be stopped and restarted by ordinary cranking after an interval amounting to as much as a couple of hours, without removing the cover of the carburetor.

## Crawler-Traction Member for Wheeled Tractor

JUST as soon as any automotive product is marketed in sufficient quantities so that its distribution is general, then other manufacturers devise attachments to increase the usefulness of the machine or to adapt it for certain work that it would not perform so creditably by itself. An attachment that is said to double the drawbar pull of a well known light tractor of the wheeled type that is made in large quantities, operates on the "crawler" principle and is designed to replace the traction wheels ordinarily supplied by the manufacturer. Needless to say, these traction members provide much more ground contact than wheels and can be used in soft and boggy soil where wheels, even with lugs and extension rims, would be at a marked disadvantage. Two widths of track are available, nine-inch, for use on hard ground, and twelve-inch, for soft places where more ground support is needed. The widest type has pressed steel grouters riveted to manganese steel links to increase the traction. It is stated that the attachment can be installed in place of the wheels in about an hour.

**Plowing an asphalt street with a wheeled tractor, equipped with special crawler-traction member**

# Recently Patented Inventions

*Brief Descriptions of Newly Invented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.*

### Pertaining to Aeronautics

PROPULSION MEANS FOR FLYING MACHINES.—A. E. BEEBE, Box 34, Cathay, N. D. The object of the invention is to provide propulsion means which is adapted to propel the flying machine either forwardly or upwardly, the direction of travel being thus readily varied by varying character of the action which is readily controllable. Another object is to provide propelling means which may be utilized to retard the descent of the plane.

AIRPLANE.—J. S. SABEY, Paia Maui, Territory of Hawaii. The invention relates to an airplane that is supported in the air and uses the water as a means of propulsion. The essential part of the invention is the propeller which is not arranged to rely on the air for a reacting means, its purpose being to engage the water, and it is secured in such a manner that the tips of the blades engage the water surface as a reacting means. (See Fig. 1.)

### Pertaining to Apparel

GARMENT.—A. SILVERSTEIN, 817 Broadway, New York, N. Y. This invention relates to a detachable vest for coats. An object resides in the provision of a vest which can be applied to a coat with a minimum disturbance of the construction of the coat proper, so that the fit of the coat is in no way affected. A further object resides in the provision of means whereby the ends of the vest, when not in use, may be slipped in back of the coat facing and fastened therein, so as to have the appearance of an ordinary coat lining.

HAT RETAINING DEVICE.—O. H. LEMCKE, c/o Rogers Printing Ink Co., 404 W. 27th St., New York, N. Y. The primary object of the invention is to provide a device for retaining a hat or other head wear securely in place and against accidental displacement from the head, the device affords ready means for detachably associating the same with a hat, cap, or head wear, and means for adjustment in order that the device may be applicable to heads of various sizes.

### Electrical Devices

RENEWABLE PRIMARY DRY-CELL BATTERY.—W. S. DOE, c/o Doe Electrical Device Co., Kent, Ohio. The object of the invention is to provide a renewable dry-cell battery arranged to enable the user to readily disassemble the parts, renew the combined depolarizer and excitant or the zinc element, and reassemble the parts to again have an effective battery the same as originally placed on the market, the battery is exceedingly serviceable for use in self-contained electric lamps.

ELECTRIC CONTROLLING DEVICE.—W. W. DRUMMOND, 323 No. Main St., Pratt, Kans. This invention has for its object to provide an electric controlling device for typesetting and other machines using a controlling keyboard, and arranged to permit an operator to selectively actuate the desired mechanisms of the machine without requiring much shifting on the operator's part. Another object is to permit the use of the controlling device without the use of the usual keyboard, and to permit the removal of the device whenever it is desired to actuate the machine by the use of the keyboard.

SOCKET COVER.—M. BERMAN, c/o Reliance Metal Spinning Co., 160 John St., Brooklyn, N. Y. The invention relates to electric light fixtures, its object is to provide a socket cover so constructed that it may be adapted for use either with a ball or spherical lamp or with a pear-shaped lamp and shade as desired, without the necessity of dismantling and disconnecting the socket cover from the rest of the fixture, the cover plate being connected to the body portion of the socket cover by a detachable joint.

LAMP SOCKET.—C. GARCILLAN, c/o Mrs. W. Nunez, 228 W. 48th St., New York, N. Y. The invention pertains more particularly to a method of constructing a lamp socket and the arrangement of the contacts thereof. One of the objects is to construct a lamp socket in such manner that the lead wires are in actual contact with the contacts of the lamp globe when the latter is positioned therein, one of the lead wires forming a means for supporting the lamp globe within the socket.

LAMP FIXTURE AND SOCKET CONSTRUCTION.—A. B. BARNES, c/o Barnes Electric Mfg. Co., 473 Central Park West, New York, N. Y. An object of the invention is the provision of means whereby the socket is in a simple and efficient manner connected to and clamped within the fixture. A further object resides in the provision of means whereby the support for the socket within the fixture and the device for clamping the parts, are utilized as a passageway for the switch operating means, which depends from the fixture.

ELECTRICAL SWITCHING DEVICE.—I. L. STANGER, 573 E. Park Ave., Merchantsville, N. J. This invention has particular reference to a combined switch or cut-out and fuse block in which the live parts are so enclosed that the danger of persons operating the switch coming in contact with them is reduced to a minimum, the live parts are also substantially enclosed regardless of whether the switch is open or closed or in any position. The fuses mounted in connection with this switch may be easily refilled and examined. (See Fig. 2.)

### Of Interest to Farmers

SEED-DISPENSING MECHANISM FOR PLANTERS.—G. H. WRIGHT, 1925 Pacific Ave., Spokane, Wash. An object of this invention is to provide a reversible seed hopper, which may be utilized for dispensing various kinds of seeds; to provide a deflector which tends to increase the hopper's efficiency, and to suggest a slightly modified form of planter organization with which the dispensing mechanism may be used. The size of the holes in the seed plates may be varied according to the kind of seeds to be planted.

PROCESS FOR REMOVING STUMPS.—J. YEGEN, 416 Main St., Bismarck, N. D. The invention has for its object the provision of a process whereby a stump is converted into charcoal before being removed. The stump is bored to provide vertical air passages extending from the top of the stump to the space between the bottom of the stump and the soil. Incomplete combustion of the wood is had by lighting the wood and covering the stump with soil.

SEED COVERING ATTACHMENT FOR LISTERS.—C. C. HERMANCE and M. REIN, c/o Max Rein, Mutual, Okla. The general object of the invention is to provide an attachment adapted to be secured in position to run in the rear of the mold board and provided with means to form a center line seed trench in the lister furrow, and trailing covering means so constructed as to close the center seed trench by soil pressure instead of covering the seed largely by throwing the dirt over it, whereby the seed contact is uniform regardless of the speed of travel of the lister.

### Of General Interest

CLEANING FLUID FOR IMPREGNATING DUST CLOTHS AND THE LIKE.—F. A. WRIGHT, 827 4th St. East, Hutchinson, Kans. This cleaning fluid consists of one gallon crude oil, one-half gallon gasoline, four ounces raw linseed oil and a few drops of oil of cassia, mixed at a temperature of not less than 72° F. The cloth is emersed in the solution, the surplus solution removed, and the gasoline allowed to entirely evaporate; it is then ready for use either on varnish, leather or glass.

CYLINDRICAL STRUCTURE AND BLOCKS THEREOF.—F. LE COCQ and I. LE COCQ, Aberdeen, S. D. The invention relates generally to cylindrical block structures such as sewers, culverts or conduits, the object being the provision of such a structure formed from blocks, whereby quick ready formation is brought about and a structure promoted involving a minimum of material, which will be water tight and capable of resisting internal and external pressure.

WINDOW-OPERATING DEVICE.—A. HEYMAN, 239 18th Ave., Astoria, N. Y. An object of this invention is to provide means which will permit of the ready raising and lowering of the upper sliding sash of a window without the necessity of using sticks or standing upon a chair or other support. A further object is to provide a rod with threaded connection for ready disassemblage of the parts for removing the sashes, the rod being neat in appearance, and efficient in use. (See Fig. 3.)

WINDOW DOG KENNEL.—C. CHAPLIN, 258 Madison Ave., New York, N. Y. An object of the invention is to provide a dog kennel adapted to be mounted on the outside of a window sill of an apartment house or other dwelling, and connected to the window frame in such manner as to be properly supported and protected from rain, the arrangement being such that access may be secured thereto at any time from the interior of the building. (See Fig. 4.)

RACK.—W. A. HAMMOND, 112 Market St., San Francisco, Calif. This invention relates to a rack designed for holding the blocks or tiles used in the game of "mah-jongg." The rack comprises an elongated block of material having an inclined frontal ledge and face allowing the tiles to rest on the ledge in a slightly reclined position, and a back face substantially parallel to the front face allowing the rack to be turned or the same without disturbing the file arrangement.

PHONOGRAPH REPRODUCER DIAPHRAGM.—C. WHITEFIELD, Victoria, B. C., Canada. One of the foremost objects is

### 3.—WHAT MAY BE PATENTED?

**UNDER the constitution of the United States the Congress has been given power to promote the progress of science and the useful arts by granting for limited periods to inventors the exclusive right to their discoveries. Accordingly, under our statutes any person who has invented or discovered any new and useful *art, machine, manufacture, or composition of matter* may be granted a patent therefor. By discovery is meant invention, and the term is not used in its generic or broader sense. Likewise the word "art" is given a more limited meaning and in the sense of the patent law it signifies a process. In all probability the great majority of patents granted are for machines or other mechanical structures. Almost any machine when resolved into its component parts comprises a combination of old elements. If these old elements are combined in a new way or so as to produce a new or better result, the combination presents patentable novelty. Just what is a "manufacture" in the sense of the patent law is difficult of definition. Broadly speaking, whatever is made by the hand of man and is neither a machine, nor a composition of matter, nor a design, is a manufacture. The term "composition of matter" may, according to Walker, be said to cover all compositions of two or more substances and includes, therefore, all composite articles whether they be results of chemical union or of mechanical mixture, or whether they be gases, fluids, powders, or solids. Not only for so-called "mechanical inventions" but as well for designs may patents be granted under our law and the statute provides that any person who has invented any *new, original and ornamental design* for an article of manufacture may obtain a monopoly thereof for a limited period. Design patents afford protection for the esthetic creations of the inventive mind and include a vast array of subjects. The period of the design patent as distinguished from that of the mechanical patent, which is seventeen years, may be three and one-half, seven or fourteen years.**

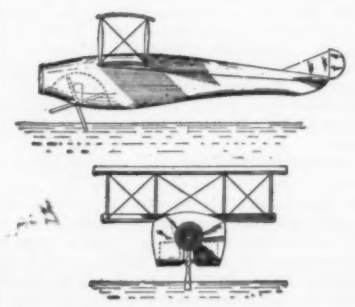


Fig. 1. J. S. Sabey's air-flying plane, driven by water screw

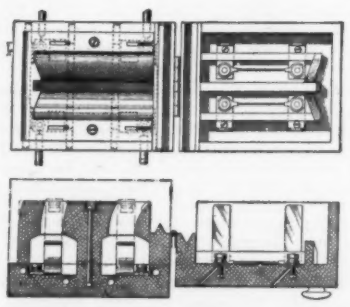


Fig. 2. Safety combination of switch and fuse block, invented by I. L. Stanger

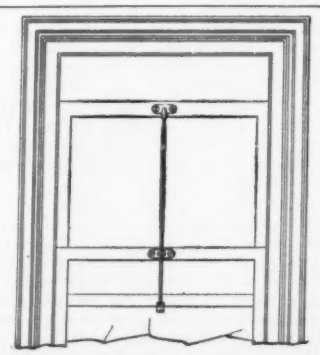


Fig. 3. The invention by which A. Heyman opens and closes the top sash

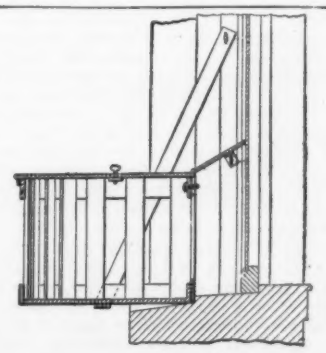


Fig. 4. Dog kennel, designed by C. Chaplin, to be mounted on the outer window sill

Fig. 5. Keeping the window-washer's arm dry with J. P. Kelly's invention

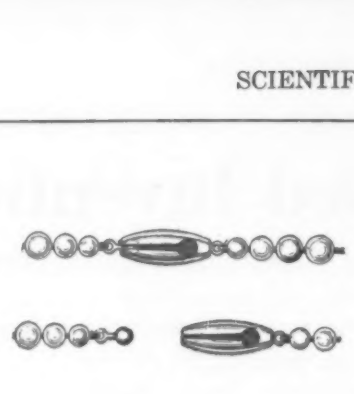


Fig. 6. J. R. Starck's version of the jewelry clasp that opens easily when desired, and not at all when not

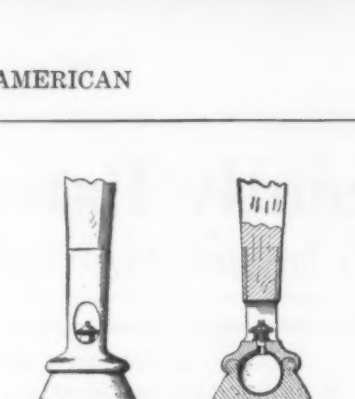


Fig. 7. Better cushioning of the shock of impact is the claim made by W. G. Bell for this crutch tip

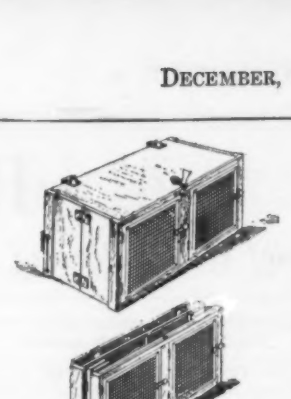


Fig. 8. Collapsible crate for shipping live stock, invented by J. W. O. Orban

to provide a reproducer diaphragm composed of a plurality of suitably assembled wooden sectors, so treated before assembly as to confer qualities thereto which enable the diaphragm to render perfect reproductions, and so mounted on parchment as to produce sounds of a high degree of faithfulness, due to the arrangement and resonance of the wooden sections.

RECEPTACLE.—F. J. LYNCH, c/o Peerless Tube Co., 28 Walsessing Ave., Bloomfield, N. J. The invention aims to provide a receptacle particularly adapted for use in connection with the shipment and storage of photographic cartridges, or spools and similar articles, but not necessarily limited to this particular use, by means of which a container will be provided, which will virtually preclude any damage occurring to its contents incident to atmospheric conditions or moisture.

BOX.—C. A. FOX, 276 6th Ave., New York, N. Y. The aim of this invention is to provide a receptacle comprising a lid and body, the elements of which will co-operate with each other in such a manner as to effectively preclude the entrance of dust or foreign matter, or the possibility of withdrawal of any of the contents of the receptacle without either visibly injuring the receptacle, or entirely removing the lid, thus necessitating the destruction a sealing means.

SNOW GUARD AND FENDER.—H. N. SIEGER, 211 E. Church St., Slatington, Pa. The invention relates to guards for preventing a large volume of snow collected on a roof from sliding therefrom. The principal object is to construct the guard or fender in such a manner that the same will have a bearing on a plurality of adjacent shingles in order to distribute the load for preventing damage to the roof as well as to insure a strong connection.

REPAIR DEVICE FOR FISHING RODS.—D. MCC. HUDSON, Bend, Oregon. The primary object of the invention is to provide means by which repairs to fishing rods and similiar articles may be made. It is a further object to provide means whereby the tips, ferrules, and the like, of fishing rods and similar articles may be securely fastened in place in such a manner that they may be readily removed when desired.

BOTTLE CAP REMOVER.—T. C. RUSH, c/o Hay Hardware Co., Lexington, Ky. An object of the invention is to provide a bottle cap remover of extremely simple and effective construction which may be readily attached to a support and positioned in such manner that, when not in use, it will occupy a minimum space and form no outwardly extending projection beyond the base of the device.

HAIR WAVING DEVICE.—O. J. HUNGERBUHLER and C. SCHOPPE, 732 Quincy St., Brooklyn, N. Y. Among the principal objects of the invention is the provision of a core member for permanent hair waving devices which effects a wave of gradually increasing size from the root to the outer end, more closely resembling the natural wave. A further object is to provide a device which eliminates the necessity of tying the hair at the roots, and which admits of an expansion of the hair after being applied to the core.

WATERPROOF CARRYING CASE.—J. D. KELLY, 78 Whitney Ave., Elmhurst, N. Y. An object of the invention is the provision of a waterproof case especially designed for bathers, which is adapted to contain cigarettes, matches, cosmetics, money, or the like, which is provided with means for attaching the same to a beach costume whereby the wearer may enter the water when the case is closed, with assurance that the contents will remain dry.

SANITARY TOILET SEAT COVER.—J. L. SCHAEFER, 80 North 30th St., Flushing, N. Y. The invention relates to covers for toilet seats and aims to provide a sanitary covering element which is designed to be destroyed after having been once used in order to insure the user against contact with the seat and against infectious diseases or the like; the device is simple and may be inexpensively manufactured.

POCKETBOOK. — B. STEMBER, 1261 Broadway, New York, N. Y. The invention more particularly relates to ladies' pocket books, hand-bags, and the like, in which a main change receptacle serves for the carrying and supporting means of a plurality of pockets arranged on either side thereof. Among the objects is to provide a hand-bag with a pocket of the accordion type and a safety pocket upon the exterior of the frame of the bag.

FIREPROOF TANK.—W. S. HUFF, 2113 W. Maple St., Stock Yards Sta., Oklahoma City, Okla. Among the objects of the invention is to provide a fireproof tank for holding oil and other inflammable liquids, the basic principle being a cover or floating tank on the oil with suitable means for sealing the joint between the floating tank and the outer stationary tank.

GAS-REGULATING VALVE.—L. E. TROSCLAIR, 2622 Lavender St., New Orleans, La. The invention has for its object to provide a valve which is operated by varying pressures of steam in a boiler to automatically diminish or increase the flow of gas, but at the same time prevent the flow of gas to a burner from being entirely stopped, this last provision functioning like a pilot.

LUNCH HEATER AND CARRIER.—J. WEISS, 1413 N. Halsted St., Chicago, Ill. An object of the invention is to provide a lunch heater and carrier, which may be placed over a fire to warm the contents, the carrier being so constructed that the fire cannot burn the food. A further object is to provide a device in which the different kinds of food are kept separate, the device when assembled forming a compact unit.

DESK ORGANIZER.—R. J. TURNER, c/o Efficiency File Co., 218 So. Clark St., Chicago, Ill. The invention relates to a device having means for conveniently receiving, in classified order, various papers and letters such as ordinarily gather on the desk of a business man. This device is constructed in such form as to make it particularly adapted to hold a plurality of papers without losing its shape or assuming a bulky appearance.

SEALING RING.—L. FOOT, Pedro Miguel, Canal Zone, Panama. An object of the invention is to provide a sealing ring which is adapted to form part of a liquid shaker and to be interposed between the mouth of a pair of ordinary glass tumblers, sealing the mouths of both, to form a shaker, the ring being simple in construction, easy to clean and efficient in use.

CONTAINER.—A. H. BOSWORTH, Zona Bldg., Wichita, Kansas. Among the objects of the invention is to provide a container or receptacle for receiving compositions, such as menthol, to be used as an inhaler, it being possible to make the container with a minimum number of parts and yet result in a strong compact article produced with a minimum expenditure of time and labor.

MOP WRINGER.—E. P. POULSEN, Mendham, N. J. The invention has particular reference to a mop wringer which is designed to be associated with a bucket or pail to remove the majority of water and discharge the same in the pail. A further object is to provide an adjustable device whereby the same will operate in connection with buckets of various heights, and may be expeditiously associated with or removed from the bucket.

BOOK-HOLDER.—M. J. CAFFREY, 319 W. 126th St., New York, N. Y. The invention especially pertains to a book-holder adapted for attachment to an article of furniture, such for instance as a chair, bed or the like. The primary object is to provide a form of book-holder which may be adjusted to various angles to meet the requirements of the article to which it is attached, and to provide means for keeping the book in open position.

CHANNEL BRICK.—A. HARDONCOURT, c/o Munn, Anderson & Munn, Woolworth Bldg., Broadway, New York, N. Y. The object of this invention is to provide a construction of channel brick employing a novel form of grip for handling the brick, the sides of the channel being so shaped that the mason's thumb and fingers may readily obtain a good grip without danger of injuring his knuckles against the rough surfaces of the brick, the brick is strong and is not unnecessarily weakened by the forming of the channels.

WRISTLET.—J. P. KELLY, 207 Eighth Ave., New York, N. Y. The invention relates to a protector adapted to be used in washing painted surfaces, windows, etc. The primary object is to provide means adapted to be worn upon the arm of the operator to catch the drip from a sponge, cloth or other washing implement. The device may be readily attached or detached from the wrist of the operator, it is constructed in such manner that one of the edges is flared, and will keep this position while in use. (See Fig. 5.)

FAUCET.—T. COONAN, Morgan Hotel, Detroit, Mich. One of the principal objects of the invention is to provide a faucet which for the filling of glasses, cups or the like, is adapted to operate automatically in that the valve of the faucet may be opened by positioning the glass or cup under the mouth of the faucet and in engagement with the operating mechanism, the faucet being also adapted to operate as a non-automatic fixture, and may be manually operated for the filling of buckets or large containers.

CLASP FOR JEWELRY.—J. R. STARCK, Weehawken, N. J. The invention pertains more particularly to a clasp for connecting together the ends of necklaces, bracelets, and the like. One of the primary objects is to provide a clasp which will be securely held against accidental displacement of the members relative to one another, a further object is to provide a clasp which may be readily opened and closed. (See Fig. 6.)

TIP FOR CRUTCHES.—W. G. BELL, 1410 M St. N. W., Washington, D. C. The object of this invention is to provide a crutch tip adapted to serve as a pneumatic cushion to absorb the shocks which may be imposed upon the end of the crutch. A further object is that the tip be adapted to grip the surface upon which it may contact during the use thereof. The tip is adapted to be inflated to any degree desired. (See Fig. 7.)

FOLDING CASE.—J. W. O. ORBAN, 824 Locust St., Scranton, Pa. This invention relates to folding cases, crates or coops, which, when in set up condition, are designed for the purpose of shipping animals or poultry, and are also designed to be collapsed when empty for the purpose of reshipment, whereby the same will occupy a minimum amount of space. One of the principal objects is to provide a case in which all of the elements are permanently connected to prevent possible loss. (See Fig. 8.)

FREE CHAIN HOIST.—F. W. COFFING, c/o Love & Kilgore, 204 Daniel Bldg., Danville, Ill. The object of the invention is to provide a chain hoist wherein the chain operates through a frame so as to be housed and protected. A further object is to provide a chain hoist in which the chain and frame are so organized with each other and with the driving mechanism that the heavy stresses are evenly distributed thereby endowing the hoist with features of strength and durability.

CONTAINER.—F. B. WENDEL, 3010 Clarendon Rd., Brooklyn, N. Y. This invention relates to containers for powdered or granulated materials such as spices, condiments or the like. The object is to provide a closure which affords means for sifting the contents in quantities, which closure is rotatably mounted on the top of the container for selectively shifting the same to its various discharge positions.

ROLLED BELT LACING.—H. HEMMERDINGER, c/o J. H. Hemmerdinger & Son, 422 Withero St., Brooklyn, N. Y. An object of the invention is to provide a simple package whereby a plurality of rolls of belt lacing may be packed away in a neat manner so that in displaying or using the belt lacing an individual roll can be extracted for use without the necessity for unwinding a large roll, or disturbing the package.

JUVENILE BLOCKS.—W. C. HADLEY, cor. 116th St. and Morningside Ave., New York, N. Y. The invention relates to a set of blocks arranged to rest upon the projecting ends of the white keys of a self-playing piano, and having upon their faces amusing pictures of humans and animals, to simulate dancing and jumping figures, said blocks being cubical in form; and also embodying spacing blocks to be interposed between the cubical blocks, all the blocks being operated by the up and down movement of the keys of the piano while playing a piece of music.

DENTAL ARTICULATOR OR RELATOR.—J. HOMER, 144 Commonwealth Ave., Boston, Mass. The invention has for an object the provision of means whereby the manipulation of the articulator is made easy, and in making a given set of teeth the operator can form an impression of the movement of the teeth with respect to the other jaw which can be preserved in a permanent fixed form for future use and thereby enable other teeth to be made in a much simpler manner.

CONTAINER.—P. G. ROSS, Poultney, Vt. The invention particularly relates to liquid containers, the object being to provide a container so constructed that there is no danger of pressure from the inside of the container blowing out a cork or other closure. A further object is to provide a container from which the cork may be readily removed without danger of injuring the same.

ANTIVERMIN BED.—L. ROYAK, 522 E. 78th St., Apt. 84, New York, N. Y. Among the objects of this invention is to provide means which are intended to be employed for use in connection with a bed and bedding for the purpose of trapping bed-bugs and such insects. The device may be incorporated with the bed when manufactured or may be applied to beds already constructed.

CHICKEN-BROODER COOP.—C. C. WHITE, Delhi, Iowa. The general object of the invention is to provide a brooder coop so

constructed as to keep the chickens free from the stamping of an uneasy hen when the chickens are shut in, as in the early morning or on a rainy day. The device is also vermin proof, and proof against the attacks of small animals. The construction is of knock-down form, and may be readily assembled.

BATHING CAP.—L. and M. AUSTER, 39 E. 27th St., New York, N. Y. The invention relates to caps particularly intended for use by women bathers, to avoid the annoyance caused by wet hair, and its injury due to the action of salt water. Among the objects is to provide the wearer with means of being relieved from the uncomfortable pressure of the cap against the ears, due to tension when the cap is expanded beyond its normal size and contracted against the head of the wearer. (See Fig. 9.)

COMB.—R. B. HOWARD, Golconda, Nev. The object of this invention is to provide a comb construction in such manner that the teeth are easily separable to permit an expeditious and efficient cleaning of the comb. It is also an object that the teeth be so made that in case one of them becomes broken a new one may be easily substituted therefor. The comb is simple and inexpensive to manufacture. (See Fig. 10.)

## Hardware and Tools

ROASTING FURNACE. — J. THOMAS, 210½ W. Heron St., Aberdeen, Wash. The invention aims to provide a roasting furnace which may be operated by any desirable type of fuel. A further object is to provide a device which may be readily portable, and in which the construction is simple, provision being made by which the degree of roasting may be regulated to a nicety. A further object is the provision of a device which may be of sectional construction so that the parts may be assembled to conform to operate with the type of material to be operated upon.

FURNACE FOR STEAM BOILERS FOR BURNING RESIDUAL MOLASSES. — H. A. GRIFFIN, Box 613, Honolulu, Hawaii. The invention relates particularly to a steam generating apparatus which will burn and thus utilize for steam generating purposes residual molasses and like products of waste fluid, the object being the provision of a simple effective apparatus capable of ready extension in its adaptability to steam boilers of various widths and applicable in a simple manner to boilers of various types. Among the purposes is to uniformly feed the molasses in such manner as to promote combustion of maximum efficiency.

BOUDOIR LAMP.—F. W. USHER, 177 Montague St., Brooklyn, N. Y. The invention contemplates an inexpensive, highly attractive and ornamental illuminator preferably in the form of a doll having a hollow translucent body in which an electric illuminating means is arranged for obtaining in a subdued and temporary illumination in a bedroom, the body of the doll figure being provided with movable members constituting the means for rendering the lighting means active.

SPRING COMPRESSOR.—C. A. PRESCOTT, 147 Riverside Ave., Providence, R. I. An object of the invention is to provide a device of this character with which a valve spring may be quickly compressed, and to provide means for holding the spring in compressed position when it is removed from the compressor. A further object is to provide such a device which is simple, strong, durable and efficient in use.

CHAIN TIGHTENER.—F. V. FISCHER, Glenrock, Wyoming. An object of the invention is to provide a device which may be used to tighten all types of chains. A further object is to provide means for taking up the slack in chains where it is impossible to further tighten the same manually, and to positively lock the chain in tightened or stretched position.

LATHE CENTER.—DE WITT E. HOWARD, Box 26, R. F. D. No. 1, Ridgewood, N. J. The general object is the provision of a simple and durable lathe center in which the work receiving spindle is revolubly mounted in a hollow body in such a manner as to prevent any play, and providing in conjunction with the hollow body means for forcing the means for mounting the work receiving spindle out of the body, the work receiving spindle being rotated on ball bearings.

COMPASSES.—U. JOHNSON, 268 Martense St., Brooklyn, N. Y. Among the objects of the inventor is to provide an instrument which may be used for ordinary work in the usual manner, but which will embody a construction permitting of work or drawings being readily divided into desired proportion, the operator being able to readily duplicate a piece of work from one standard scale to another standard scale.

LEVEL ATTACHMENT.—L. W. TIFFANY, Winsted, Conn. The invention aims to provide an attachment suitably utilized in connection with levels such as are used by carpenters, and other mechanics. An object is to provide an attachment by means of which it will be possible to determine the height, or a distance in a given plane between one point and a second point, without the necessity of utilizing the services of an expert engineer.

BATH AND BASIN FITTING.—F. C. DARLING, Walton, N. Y. The invention relates to stoppers for waste pipes in bath and basin fittings. The primary object is to provide a receptacle for the reception of the stopper in order that the same may be concealed from view when not in use, the receptacle being so constructed that the stopper will be moved automatically to position.

TORCH.—I. M. HAYWARD, 5024 18th St., Brooklyn, N. Y.—This invention has for an object to provide a construction which may be quickly arranged as a torch or as an automatically heated soldering iron, wherein alcohol may be readily used as a fuel. A further object is to prevent the heat from unduly affecting the liquid part of the fuel while at the same time presenting means for conveying the fuel to the heated part of the torch for gasification.

## Heating and Lighting

BOILER AND HEATER.—P. O. ROTH, 2400 Cornelia St., Brooklyn, N. Y. An object of this invention is to provide a means for causing the water in a steam boiler to absorb more of the heat units passing through the flues, the arrangement being adjustable to take care of different conditions of fire, boiler and the like. A further object is to provide baffling or deflecting means for the boiler tubes which may operate any desired series of baffles, and an arrangement of air or steam injection which will tend to produce a better combustion and better draught.

FURNACE APPLIANCE.—O. L. RUNDELL, 603 Woodland Park, Chicago, Ill. This invention relates to furnace combustion appliances. An object is to provide a device in which oxygen is conveyed from the furnace grate to a point above the burning coal, thus assuring the combustion of the gases above the coal. A further object is to provide a device in which the parts may be readily replaced, if broken, and in which a protective sleeve is provided for that portion in close contact with the hot coal.

METHOD OF CONTINUOUSLY MELTING VITREOUS ENAMELS.—F. D. COOK, Box 459, Washington, Pa. The invention aims to provide a method of forming vitreous enamels which consists in utilizing a melting chamber formed to prevent collection of the melted enamel in a pool and permit the enamel to run continuously from the chamber as it melts, in continuously withdrawing and quenching the melted enamel and in controlling the temperature by this process.

FIRE KINDLER.—J. QUIST, 855 Howard St., Detroit, Mich. This invention relates to a device for starting fires in stoves or furnaces where coal or other solid fuel is employed for heating. The object is to provide a device adapted to be applied beneath the fire grate in the ash receiver for rapidly starting a fire, the lighting unit comprising a receptacle and a multiplicity of upstanding sheets of liquid absorbing material, such as asbestos, filled with a suitable oil.

## Machines and Mechanical Devices

PLECTRUM PIANO ACTION. — G. CASCIOTTA, 317 E. 27th St., New York, N. Y. An object of the invention is to provide a novel piano action capable of being substituted for a conventional piano action constructed in a new piano and by means of which the same tonal qualities will be capable of being duplicated by means of a piano as are now capable of being rendered only by a performer upon a harp.

LOADING AND UNLOADING APPARATUS.—J. A. WORSHAM, Maroa, Ill. An object of the invention is to provide a portable loading and unloading device particularly designed for loading freight cars or the like, and for handling ear corn, but may also be used for loading various other materials. The device is automatic in its operation, causing the tilting of a wagon to discharge its contents into a hopper, and causing the material to fall into a pneumatic discharge tube through which a blast of air distributes the same to evenly load the car.

AUTOMATIC DRILL PRESS.—C. E. COX, 610 Park Ave., Rockford, Ill. Among the objects of this invention is to provide a device in which there is an arrangement for elevating and lowering the drill spindle, and a magazine in which a plurality of tools may be carried with means for bringing any desired tool into operative relation with the drill spindle, and means for locking the tool carrying mechanism in position for releasing it at will.

SEPARATOR.—M. M. NEWTON, Colorado Springs, Colo. The invention relates to an apparatus for separating a conglomerate of solids consisting of materials having different specific gravities such as found in mining operations for redeeming precious metals from sand and gravel beds or from tailings of a mine or the like. The device comprises a helical shaped pan having a transversely curved surface, means for supporting and adjusting the pan for rotation with respect to the axis.

DRILLING MACHINE.—H. C. BREWSTER, Shreveport, La. An important object of the invention is to provide a well drilling apparatus having a sub or suspended bed arranged beneath the main bed and the rotary table of the machine, the bed being provided with suitable means for gripping a drill stem or pipe to hold the same against rotation independently of the rotary table.

SELF-CONTAINED BLOW-OFF VALVE.—C. H. STROUD, Hubbell, Mich. The invention relates generally to valves and more particularly to blow-off valves, the object being the provision of a self-contained valve, the moving part of which will be fully concealed and movable within the limits of a casing and are protected from outside influences, as well as from accidental blows.

FLUSH TANK VALVE.—S. KNEPPEL, 333 E. Locust St., Scranton, Pa. The general object of the invention is to provide a tank valve adapted to be lifted by a pull exerted on a chain or lever. The device is characterized by accuracy of operation and the facility with which the parts may be produced and assembled, as well as to obtain simplicity and durability of construction.

PUMP.—D. H. THOMPSON, 314 W. Locust St., Lodi, Calif. Among the objects of this invention is to provide a positive acting, continuously operating, combined suction and pressure pump having a continuous suction and discharge that is economical, simple and substantially built. The capacity of the pump will be contingent only upon the power exerted in operating.

FLUSHING VALVE. — W. S. WHITE, Denver, Col. The invention has for its object to provide a valve which comprises a piston and a pendant valve movable vertically relatively to the piston to function in a particular manner, an important result being that the flow of flushing water will not cause the valve to bind. The device also includes an auxiliary valve for venting a chamber above the piston.

HAIR WAVING MACHINE. — J. M. HIGGINS, 1223 15th St., Sacramento, Calif. The particular object of the invention is to provide a machine that will enable a person to produce a Marcel wave on her own hair in a very short time, without the assistance of an attendant, and without the exercise of any particular skill. The device is simple and will produce the required wave in a few minutes.

PUMPING POWER.—E. S. SLOAN, Shippenville, Pa. The invention relates more particularly to what is known in the oil well art as pumping powers. An important object is to provide a pumping power which employs an extremely heavy base into which is rotatably extended a main shaft surrounded by a suitable number of relatively stationary bearings so that the leverage cannot exert an excessive friction and thereby decrease the life of the bearings. (See Fig. 11.)

## Medical Devices

BLEEDING APPARATUS. — R. F. SCHNEIDER, 125 Manhattan Ave., Jersey City, N. J. The invention relates to bleeding apparatus commonly used for extracting blood from the body for the purpose of making blood tests. The device includes a handle having a passage therein adapted to communicate with a hypodermic needle, a rigid nipple fixed to the handle and communicating with the passage, and a flexible airtight coupling member adapted to hold the reduced breakable end of a vacuum tube within the nipple.

TONSILLOTOME.—O. C. DANIELS, Oriental, N. C. The invention relates to surgical instruments adapted for use in severing and removing tonsils, like portions of the body, and abnormal growths. An object is to provide an instrument which is simple in construction, adapted for convenient disassembly and replacement to permit of cleaning, or the sharpening of the cutting blade. A further object is to provide an instrument having relatively adjustable members adapted to grip the parts to be severed, whereby the parts will be securely held in position; the device is adapted to be operated with one hand. (See Fig. 12.)

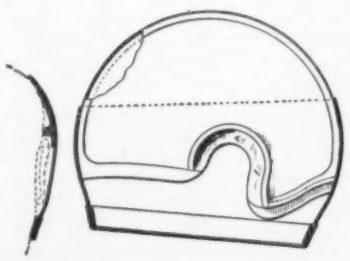


Fig. 9. The improved bathing cap for ladies, designed by L. and M. Auster

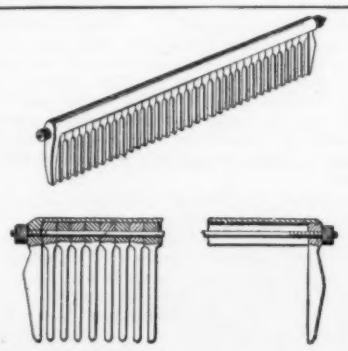


Fig. 10. R. B. Howard's comb with separable teeth to facilitate cleaning

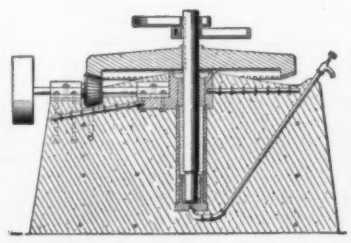


Fig. 11. E. S. Sloan has patented this better arrangement for pumping in oil wells

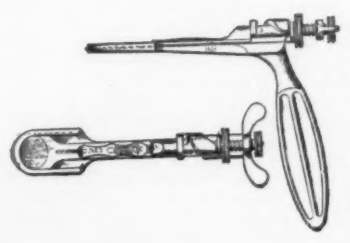


Fig. 12. Improved instrument for removing tonsils, the invention of O. C. Daniels

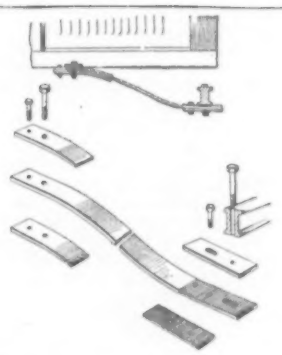


Fig. 13. Axle-alining radius-leaf adjustment invented by G. C. Robbins

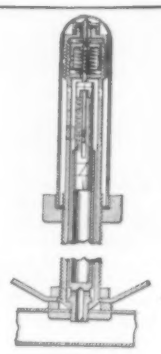


Fig. 14. W. E. Hedger's tire valve that indicates the pressure

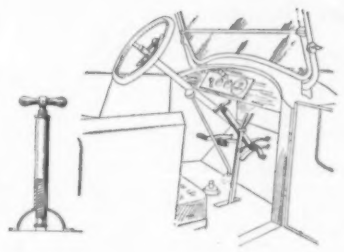


Fig. 15. Attachment by means of which E. B. Preston is able to relieve the foot on the accelerator pedal

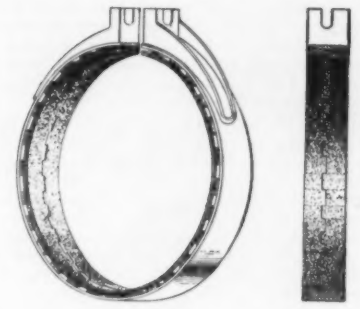


Fig. 16. Novel style of brake-band lining invented by R. Reynolds

## Musical Devices

MUSIC ROLL CONTAINER.—B. V. O'NEILL, 1839 Westchester Ave., Bronx, N. Y. This invention seeks for its principal object to provide a container for music rolls which includes a means to permit the playing of the role without removing the same from the box. Another object is to provide a container which includes means for reducing friction to a minimum, and preventing wear on the container proper.

MUSICAL-NOTE-INDICATING ATTACHMENT.—G. W. STEWART, 325 W. 48th St., New York, N. Y. This invention has for an object the provision of means whereby a person may very readily learn to play and read music. A further object resides in the provision of means whereby a musical instrument may be provided with means on its body portion to indicate a musical scale or notes in connection with which the attachment is operated.

## Prime Movers and Their Accessories

LUBRICATING DEVICE.—H. C. SHAMBLIN, c/o Shamblin Lubricating Co., Webb City, Mo. The invention aims to provide a lubricating system for use in connection with internal combustion engines by means of which an operator may adjust the supply in such manner that just the correct amount of lubricant will be utilized and evenly distributed so that all of the objections in this connection will be avoided. The device may be manufactured and applied at a nominal figure.

COMBINED COOLING AND CARBURETING SYSTEM FOR INTERNAL COMBUSTION ENGINES.—A. J. CHARLTON, Lowden, Iowa. An object of the invention is to provide a cooling system which may be applied to any engine having the usual water jacket, but which dispenses with the use of water, thereby reducing the weight and eliminating the necessity of a radiator. A further object is to provide a cooling and carbureting system in which cold air is forced through the water jacket, and the air thus heated conveyed to the carbureter.

ACCELERATOR.—C. HAMMOND and W. INMAN, Boyne City, Mich. The invention relates to accelerators for use on internal combustion engines. Briefly stated, the object is to provide an accelerator for Ford motors having means whereby the same is operated automatically by the depression of either the clutch or reverse pedals, the device may be applied without elaborately altering the construction of the engine.

CLEANING IMPLEMENT.—G. A. HOYEM, Lennep, Mont. The aim of this invention is to provide a device particularly adapted for use in connection with the cleaning of spark plugs, and by means of which an operator will be enabled to effectively clean all of the parts of the plug without going to the necessity of dis-assembling the same. The device is extremely simple and can be manufactured at a nominal figure.

GAS ENGINE.—O. NELSON, c/o Dr. D. P. Teter, 2009 Irving Park Bldg., Chicago, Ill. Among the objects of the invention is to provide a simple and efficient timing means for gas engines. A further object is the provision of means for drawing a full charge to a point—adjacent the working cylinder by means outside of said cylinder, and to provide means for opening and closing the ports of a gas engine in definite relation with each other.

SPARK PLUG.—J. S. SOLOMON, 125 Magnolia Ave., Los Angeles, Calif. A purpose of this invention is the provision of a spark plug comprising a plurality of electrodes permanently adjusted and arranged to provide a succession of spark gaps which function to intensify the spark in the aggregate and to prevent fouling of the plug.

TIMING INDEX.—V. W. PAGE, c/o Victor Page Motor Corp., Melrose Ave., Stamford, Conn. The invention relates to internal combustion motors, and pertains more particularly to means for indicating the relative position of the cam shaft and its driving mechanism to the crank shaft of the motor. One of the objects is to provide means whereby the several parts of the cam shaft and its assembly may be properly positioned, in order that when the connection between the crank shaft and the cam shaft is made, the several parts will be in properly timed relation.

ROTARY FLUID-PRESSURE PRODUCING APPARATUS.—A. J. WORTHEN, Station C., Box 1654, Los Angeles, Calif. The invention relates to compressors in which the velocity of the air, gas or other fluids is converted into pressure energy, and its object is to provide a rotary fluid pressure producing apparatus arranged to obtain a high over-all efficiency and reduce mechanical losses and losses of fluid, due to windage, to a minimum, and deliver a large volume of air or gas at a high compression ratio.

## Railways and Their Accessories

BEARING CONSTRUCTION.—V. W. PAGE, c/o Victor Page Motor Co., Melrose Ave., Stamford, Conn. Among the objects of the invention is to provide means for centering bearings and particularly the main bearings of internal combustion motors, and to provide means which serve also to automatically center and retain the bearings in position after the same has been centered. A further object is to provide a device which may be readily assembled and disassembled.

ROTARY INTERNAL COMBUSTION ENGINE.—S. B. COLLIER, Voughton Seed Co., Jersey City, N. J. The invention relates to internal combustion engines of the rotary type, the primary object being the provision of an engine which will be economical and practically without vibration in operation. A further object is the provision of an engine, the disposition and operation of certain parts of which preclude leakage, thus maintaining a uniformly high compression at all times.

COMBINED ATOMIZER AND VAPORIZER FOR OIL ENGINES.—A. C. SMITH, 2053 E. 38th St., Los Angeles, Cal. The purpose of the invention is the provision of a combined atomizer wherein the atomized oil is injected either into the vaporized member or directly into the cylinder of the engine, so that when starting the engine or running under a light load, the vaporizing member is employed to effect a thorough vaporization of the fuel, while, on the other hand, when the engine is heated to effect the flushing of oil, as it is introduced into the cylinder, or when the engine is running under heavy load, the oil can be ejected directly into the cylinder and without contacting with the vaporizer.

TWO STROKE INTERNAL COMBUSTION ENGINE.—W. J. F. WEGE, 67 Third Ave., St. Peters, South Australia, Australia. The invention comprises a two-stroke internal combustion engine for use with oil, petrol, alcohol, benzine or other volatile fuel. It is very simple in construction and operation and has no valves other than port valves. All valve operating gears consisting of cams, camshafts, tappets, tappet rods, rockers, valve guides, valve timing wheels and springs have been eliminated; it is especially adapted for airplanes, motorcycles and motor cars.

## Pertaining to Recreation

AMUSEMENT DEVICE.—J. IRSCH and J. MARKEY, c/o Flickenstein, 601 5th Ave., Long Island City, N. Y. The invention has for an object to provide a construction wherein the players may see the effect of their efforts during the progress of the game, and wherein a number of objects are caused to travel from one part of a track to another through the manual operation of an actuating mechanism, which if not properly operated will fail to perform the desired function.

GAME APPARATUS.—K. O. STROMEE, 465 H St., San Bernardino, Calif. An object of this invention is to provide a game apparatus consisting of blocks or rectangular game pieces having numerals thereon arranged in such manner that a game or games may be played which exercises the mental faculties in problems of arithmetic and which constitutes a game of skill as well as of chance. The game may be played by children or adults and lends itself to a wide variety play to exercise the player's ingenuity.

GAME.—R. DONER, 120 E. Ohio St., Chicago, Ill. An object of the invention is to provide a device in which certain moving parts are manipulated in a manner to ascertain the score of the players, the device having a dial and an indicator hand, both of which are movable relative to one another and to the supporting means. The score may not be predetermined by an unfair manipulation of the device.

## Pertaining to Vehicles

DOOR HANGING AND SECURING MEANS.—J H. STEWART, 99 Woodward Ave., Rutherford, N. J. Among the objects of the invention is to provide a freight car door adapted to have lateral movement to or from the doorway in addition to its sliding movement, whereby to effect a tight fitting of the door in the doorway. The general object is to provide a suspension means for the door, whereby the door may be readily opened and quickly and tightly closed.

LIFTING DEVICE.—F. G. CLINE, 311 W. Adams St., Neosho, Missouri. The general object of this invention is to provide a lifting device for application to the Ford automobile, so constructed as to be adapted for engagement with the front cross member of the frame for repairing the steering gear, wheels, etc., or for lifting the side frame bars, or the rear end without damaging parts of the car body in the various necessary operations of repair.

TIMER.—E. J. LEE, c/o Never Break Products Co., S. Murray St., Bangor, Pa. This invention relates to a timer including a ring, a contact member encircling said ring, antifriction means interposed between said ring and member, a collar carrying the ring, a plate carried by the collar and expanding outwardly therefrom, and a spring pressed pin carried on the outer end of the plate and bearing against the contact member.

VEHICLE SHOCK ABSORBER.—G. HENLEY, 382 E. College St., Meadville, Pa. An important object of the invention is to provide a shock absorber which is especially adaptable for use on automobiles in connection with the front and rear springs, which may be equally as well applied to various types of automobiles in an effective manner and which so absorb the shocks due to rebound or recoil that jarring will be substantially eliminated, and especially the upward movement of the vehicle.

OIL INDICATOR AND PUMP PRIMER.—G. F. MADDEN, Roosevelt, Utah. The invention is intended for embodiment in oil indicator reservoirs employed on automobiles. The general object is to provide an indicator reservoir so formed and connected up with the pump that oil will be received in the reservoir from the pump and oil from the reservoir may be returned directly to the pump when required, for priming the latter.

AUTO ATTACHMENT.—H. D. COOK, 2204 Cleveland Ave., Terre Haute, Ind. Among the objects of the invention is to provide a simple attachment for felloes of wheels of ordinary construction which are adapted to act in conjunction with the felloes to permit of a demountable rim being locked in position or released as quickly for dismounting therefrom. The device is adapted to be applied without any change being required in the wheel.

ADJUSTABLE CHAIN HOOK.—O. E. BROWN, 51 Ferguson Ave., Buffalo, N. Y. The aim of the invention is to provide an adjustable coupler or hook, for employment in any suitable relation, but for use preferably on the circumferential chain member of an anti-skid chain. The hook is of simple and rugged construction and easily adjusted to take up slack in a chain and lock the same against accidental disengagement.

RADIUS LEAF.—G. C. ROBBINS, Blowing Rock, N. C. The invention relates generally to radius leaf adjustments adapted for use with the front axle assembly of vehicles, but the adjustment may be used to advantage on other kinds of machinery. One of the principal objects is to provide a radius leaf adjustment by means of which the axle of a vehicle can be readily alined, the leaf being securely associated with the chassis and axle after adjustment so that its capacity to carry out the functions of a rigid radius leaf are in nowise impaired. (See Fig. 13.)

SAFETY VALVE AND PRESSURE INDICATOR FOR AUTOMOBILE TIRES.—W. E. HEDGER, Box "C," Waupun, Wis. This invention relates to the air valve for the inner tubes of tires, and the general object is to provide a tire valve having an assemblage functioning as a pressure indicator in the pumping up of the tire and functioning as a safety valve for the relief of undue pressure under excessive heating of the tire. (See Fig. 14.)

ATTACHMENT FOR MOTOR VEHICLES.—E. B. PRESTON, Mexico, Missouri. The invention relates to the accelerator control of internal combustion engines. An object is the provision of an attachment for the accelerator pedal by means of which the operator is able to relieve his foot, and use one of his hands for operating the pedal. By this device the operator may use his foot in cases where it is desired to lower the pedal for a short interval, or may use the adjustable hand attachment for maintaining the lever in the desired position for a long period. (See Fig. 15.)

BRAKE-BAND LINING.—R. REYNOLDS, 29 Glencoe Place, Cincinnati, Ohio. The invention relates to a method and manufacture of a form of brake-band lining such as are employed upon motor vehicles or the like. The object is to provide a lining adapted to be associated with any standard form of brake band and serve in a highly efficient manner as a friction braking medium with a relatively long "service life." The lining is adapted to be made without any loss of the friction material constituting the same. (See Fig. 16.)

# The Scientific American Digest

*A review of the technical and trade press, consisting of abstracts from leading articles announcing the newest developments in industry and engineering*

*Exact references to the sources from which these abstracts and quotations are made follow each abstract, the numerals referring respectively to the volume, number, and pages occupied by the original article in order that those who wish for further data may refer to the originals. Other digests appear in Electrical Notes, Service of the Chemist, Motor-Driven Commercial Vehicle, and other departments*

## Automotive

**The Gasoline Shortage Scare** which swept the country a year or two ago has been greatly minimized by more recent investigations. Already gasoline substitutes are playing an important part in automotive development in foreign countries. Researches into the production of fuel have been made by low temperature distillation, by the use of benzol, by the hydrogenation of naphthalene, by the study of various uses for tar acids for motor fuel, when converted, and by the treatment of coal with ozone and its conversion into liquid products by the Bergius process.—*Automotive Industries* 49:9 pp. 432-35.

**Eucalyptus Oil as a Motor Fuel** has been experimented with in Australia. C. M. Dyer is said to have demonstrated that it can be used in petrol engines with efficient means of vaporization. The only difficulty he has encountered is that it will not start an engine from cold without priming. But its calorific value is high. Tests made with cheap cars which showed 24 miles to the gallon with gasoline, showed 28 miles with half gasoline and half eucalyptus; and 36 miles on eucalyptus oil alone. Eucalyptus oil mixes with gasoline, benzine and alcohol and acts as a decarbonizing agent. The main difficulty of manufacture on an extensive scale would be in securing laborers to gather the leaves.—*Industrial and Eng. Chem.*, 15:9 p. 897.

**Gasoline Blends**, listed in the order of their importance, are benzol, kerosene, alcohol and ether, these being mixed with the gasoline in various proportions. Since benzol is obtained chiefly as a by-product in coke-ovens, distribution centers of benzol-blended gasoline are to be found exclusively in cities which support industries requiring coke-ovens on a large scale. But as the sources of benzol increase, more and more use will be made of this very desirable fuel. Even though costing more per gallon than plain gasoline, the blended fuels give greater power, greater economy in fuel consumption, better operation of the engine, so that the total cost of operation is less than with gasoline in spite of the higher price per gallon. All considerations of cost may be swept aside if a fuel is superior in starting, accelerating and reliability. But it has not been demonstrated that any blended fuel is superior to good gasoline at prevailing prices. If gasoline increases to fifty cents per gallon, an alcohol-benzol-kerosene mixture, high in alcohol, would have commercial possibilities. Blended fuel is worth perhaps two cents more per gallon, but a price differential of three to five cents is not justified by the advantages gained.—*Mech. Engineering*, 45:10, pp. 577-78.

**A New Water-Cooling System for Automobile Engines**, known as the Lonergan system, which includes a condenser for steam formed in the cylinder jacket, a novel form of radiator construction, characteristics which are said to prevent injury due to freezing, and means for rapid thawing out if frozen up, has recently undergone tests which appear to have demonstrated the ability to produce satisfactory cooling under severe conditions. Either a pump of the usual centrifugal type or thermosiphon circulation has been employed. A positive pump is not required. Neither is any pressure relief valve needed. This system has a tight filler cap, and the only opening to the atmosphere is the vent at the top of the condenser. Water from the bottom of the radiator enters the cylinder jackets either by pump or thermosiphon action, no special pump being employed. The hot water and steam pass over to the top of the radiator, where condensation and cooling take place. Part of the steam goes to the condenser, where the condensate soon forms a water-seal. When the engine is throttled down, or the cooling blast of air is accelerated sufficiently to make condensation more rapid than evaporation, a partial vacuum occurs in the top of the radiator and returns the water from the condenser.—*Automotive Ind.*, 49:12, pp. 581-82.

**The New, Low-Pressure or "Doughnut" Tires** have received a very favorable reception at the hands of French motor-car manufacturers. These tires have clincher bead cord construction. The bead is stiffer and deeper than on the ordinary tires, but the sidewalls are very much thinner. Recommended pressures are fifteen pounds per square inch for the smaller sizes used on two-seater cars, and eighteen pounds for the larger tire on four-seater models. These are lower pressures than other makers who have experimented with large-section tires have considered advisable to adopt.—*Automotive Industries*, 49:12, pp. 581-82.

**The Annual Sale of Motor Cars in Australia** now amounts to about 16,000, and since the buying capacity of nearly every Australian is probably slightly higher than that of the average American, the demand will grow. Cars in Australia are used essentially for business purposes. American makes of cars and trucks predominate, and it is estimated that 75 or 80 per cent of the motor cars sold in Australia are manufactured in the United States or in American factories established in Canada. Under the stimulus of high tariff duties, body-building and tire manufacturing have grown to be very important industries in Australia. At present, Adelaide is the seat of the motor body industry. One Adelaide plant alone employs over eight hundred men, and turns out ten thousand motor bodies a year, which is about sixty per cent of all the motor bodies manufactured in the country. Fifty per cent of all the tires and tubes sold in Australia are made there, and half of the remaining fifty per cent come from the United States.—*Amer. Machinist*, 59:13, p. 480.

## Civil Engineering

**Storing California's New Oil.**—Within the last twelve months there have been completed in southern California new oil tanks with a combined capacity of 14,500,000 barrels, and new reservoirs with a combined capacity of 21,500,000 barrels. The storage now building amounts to over 8,750,000 barrels in steel tanks and 23,000,000 barrels in concrete-lined, earthen reservoirs. In the Los Angeles basin, seventy-five cents per barrel may be taken as a fair unit cost for building steel storage, and thirty-five cents per barrel for concrete storage.—*Mining and Oil Bull.*, 9:9, pp. 752-765.

**Utilization of Methane Gas from Imhoff Tanks.**—Since the time when sludge chambers were first used in sewage disposal it has been known that the gases developed were useful owing to their high content of methane, marsh gas or fire-damp. The gases have not been much utilized in the past because it was considered necessary to build large roofs above the water level to collect them. There has recently been constructed in the Ruhr coal district the first large municipal sewage works with provision for collecting all the gas produced. In the new type of vent-chamber there is constructed, about three feet below water level, a nearly horizontal roof which has an opening in it about three by two feet in size. Over this opening a funnel-shaped gas hood is placed, the bottom edge of it projecting about one foot below the surface of the water. In a year's time a quantity of gas equal to 0.3 cubic feet per capita per day can be assured. A city of 100,000 can figure on 11,000,000 cubic feet of combustible gas per year. Among other uses, this gas is very useful for welding and cutting, as it is free from hydrogen. The added cost of the gas-collect-

**Locomotive Smoke in Tunnels** is the subject of investigations made by the Bureau of Mines in tunnels of the Union Pacific Railroad. This work was the outcome of several accidents which occurred to train crews passing through the tunnels, caused by pollution of the air by exhaust gases from freight locomotives. Gas samples and temperature readings were taken and the symptoms and physiological effects produced on the crews were studied. Pulse rates and body temperatures were taken, and the determinations of the carbon monoxide content of the blood were made. It was found that in a normal running time of six minutes through one tunnel the temperature rose to 114 degrees F., and the relative humidity was ninety per cent. Physiological tests showed that an exposure of 4½ to 8½ minutes to atmospheres containing 0.05 to 0.29 per cent carbon monoxide produced a blood saturation of five to eighteen per cent. Smoke deflectors decreased the temperature of the cab atmosphere twenty to thirty degrees. The results of physiological tests over periods of ten minutes showed that the conditions in the cabs might be severe enough to cause asphyxiation or exhaustion in twenty minutes, especially in cases where the engine is stalled. It was found that the train airbrake line may be used as a source of air for breathing purposes for a period of ten minutes, and in combination with the air tanks in the train pipe, acting as a reservoir, will afford a supply of pure air for thirty minutes.—*The Railroad Herald*, 27:9, pp. 37-38.

**Japanese Engineers** have tended to make a steel building which would be sufficiently rigid in itself to move as a single unit without distortion among the several parts. The main difference in construction details between the Japanese and American designs lies in the columns, the connections of the beams to the columns, and particularly in these elements as they occur in the outside walls of the buildings. The spandrels are unusually heavy and are fitted with diagonal bracing, tying them to the columns in a way calculated to prevent any relative movement between the two. The column splices are exceptionally heavy and in some cases are as long as a story height. As many as four splice plates, with close to 200 rivets through them in four rows, are fitted on each side of the column. All these buildings are erected on the sand underlying Tokio. They are carried on piles forty to sixty feet in length. The footings of stone concrete, with a large amount of stone reinforcing, are poured around the heads of the piles and the individual column footings are tied together by reinforced concrete beams, forming in effect an enormous mesh with space between members equal to the column spacing. A reckoning of the steel buildings in Tokio gives one steel building which measures 331 by 300 feet, and is eight stories high. Another measures 152 by 286 feet, and is seven

ing apparatus amounts to one per cent of the cost of constructing the Imhoff tank plant. In the Ruhr the receipts from the sale of the gas covers over half of the total operating costs of the Imhoff tanks.—*Eng. News-Record*, 91:13, pp. 512-14.

**A New Method of Measuring the Flow of Water in Conduits** is based on obtaining a record of the changes of pressure that occur in a conduit when the water therein is brought to rest. Steady conditions of load on the turbines are maintained as uniform as possible. When the usual observations of head, power, etc., have been made, the turbine gates are gradually and gently closed so as to shut off the supply of water to the turbine. Immediately preceding and during the closure of the gates and for a short time afterward there is obtained a record of time intervals and of the changes of pressure that occur in the conduit. This record is obtained by means of the Gibson apparatus, which is connected through the wall of the conduit by a piezometer opening at any convenient point upstream from the turbine casing. After the closure, when the disturbance in the penstock has subsided, the same apparatus is used to record the static pressure then existing in the conduit. The complete record is called the pressure-time diagram, and when properly interpreted is a precise measure of the mean velocity of the water in the conduit at the moment the gates began to close. Measurements made at the hydraulic laboratory of Cornell University showed that the mean variation from volumetric measurement was less than 0.2 per cent, and the maximum variation of any one measurement was 1.6 per cent.—*Engineers and Engineering.*

stories high. A third is 153 by 159 feet and is seven stories high. There is also a fourth seven-story building. In addition, there are half a dozen five and six story steel buildings. In Yokohama, none exceed three stories.—*The Iron Age*, 112:11, pp. 685-86.

**Shaded Topographic Maps** have been experimented with by the United States Geological Survey since several years. With the recent production of shaded topographic road maps of the region of Washington, D. C., the Survey has made a further step to improve the legibility of its regular topographic maps by shading. The combination of shading and contouring is considered to be well adapted to use for regular engineering purposes. A number of sheets in West Virginia and Pennsylvania are in course of preparation and it is intended to publish them in the near future as a means of securing an expression from users as to the value of this method of showing relief. If opinion is favorable, other maps in various parts of the United States will be produced. The shading is so applied as to produce the effect of a sculptured relief model under oblique illumination. Dark tints of color are used for low lands and lighter tints for high lands. Where the topographic survey of a state has been completed and published maps exist, a shaded relief map on the scale 1:500,000 will be prepared. Such a map has been made, for instance, of Ohio.—*Eng. Record*, 91:10, p. 382.

**A South American Railway Development** which will probably cause important changes in trade routes is the Salta-Chile extension of the Argentine State Railways, now under construction, to connect with Antofagasta. The object of this line is mainly the development of the northwestern provinces of Argentina, which comprise one of the most promising regions of the world for extensive development, being capable of producing practically everything grown in tropical, sub-tropical and temperate zones. The line will carry a large part of the imports now going to Buenos Aires from the United States, as they will probably seek the shorter route.—*Eng. News-Record*, 91:9, pp. 332-36.

**The Two-Strip Highway** consists of two 8-foot slabs of concrete with a center strip four feet wide of oil macadam, and two 2-foot shoulders of macadam at the sides. The two-strip type of highway is safer for driving at night because of the plain demarcation of the road.—*The Highway Mag.*, 14:9, p. 10.

**Asphaltic Concrete for Road Foundations.**—A study of western construction reveals the fact that during the last ten years great strides have been made in road foundation work, particularly through the extensive use of the foundation family known as "black base" or asphaltic concrete. Upward of 15,000,000 square yards has already been laid and has proved successful. East of the Mississippi, foundations of this type have been used in only a few widely separated places. Asphalt is used as the binding material in black base construction, and broken stone or gravel is used as the aggregate. The ductility of this base prevents cracking and disintegrating from the expansion caused by temperature changes. Its flexibility assures constant, uniform contact with the subgrade and gives to the pavement its maximum bearing and carrying capacity for the traffic load. It is claimed that the reduced cost of maintenance with this type of base is even greater than its other advantages. When depressions occur it is unnecessary to remove the entire base to repair it.—*Am. City*, 29:3, p. 234.

### Industrial Progress

Gas is becoming an increasingly potent factor in the baking industry. Recent developments have made the direct-fired gas baking oven a real competitor of the coal-fired oven. Cost of fuel is not the proper basis on which to compare the two kinds of baking ovens. That gas-fired ovens are preferred in spite of a higher fuel cost is demonstrated by the steady increase in its popularity among the bakers. In 1920, the first large, continuous, direct-heated gas oven for the baking of bread was placed upon the market. Today, more than 100 traveling plate bread ovens, direct-heated by gas, are in operation or in course of construction in Canada and the United States. The weight of the direct gas-heated oven can be held down to practically one-fifth that of the flue oven. This simplifies installation, reduces expansion and facilitates heat insulation. The upkeep costs are lower and if repairs

are necessary, the oven can be cooled in a few hours instead of days.—*American Gas Journal*, 119:8, pp. 155-56.

**A New Southern Industry.**—In 1915, 1916 and 1917, when the quest for resources for every industry was at its height, engineering surveys showed that millions of dollars lay dormant in the unworked resources of the South. The War focussed the eyes of the balance of chemical United States on the southern states. The railroads took up the cry at first with the idea of developing the territory along their routes. Various chambers of commerce of different localities put their shoulders to the wheel. Within five years, as a consequence, what was once considered a dream of the far distant future has become, with startling rapidity, a reality. Particularly in chemical manufacturing, plants have sprung up all over the South, many of them since the end of the War, manufacturing everything from proprietary medicines to coal-tar distillates and sulfuric acid.—*Manufacturer's Record*, 84:11, pp. 71-72.

**The Cost of Bricklaying Labor** is the target for considerable unfriendly comment in the newspapers, but because the day's work of the bricklayer can readily be expressed in the form of a unit of work—brick laid per day—a unit of work easy to check and easy to discuss, his production is too often mentioned in a deprecatory way by those who are dissatisfied with building labor in general. Most people fail to remember that the bricklayer, in common with all other craftsmen, now works eight hours a day instead of ten and that the record amount of brick laid per day, which sticks in their memories, was probably laid in a wall thicker than the walls are built today; and that the thicker the wall the faster the brick are laid.—*Common Brick Mfr's. Assn.*

**Balsam-Wool** is a new heat insulator which is being used for the construction of ice boxes and refrigerators, and in the building of comfortable homes. This material weighs only three pounds per cubic foot, less than half as much as balsa wood and about one-fourth as much as cork. When tested for thermal conductivity, balsam-wool showed the remarkable thermal conductivity of 6.1 B.t.u., as against 8.3 for balsa wood, and 7.4 for fine cork. These latter are the most efficient heat insulators made from wood heretofore known. Patents were granted on both the product, balsam-wool, and the process of making it and it is now being made in Minnesota. About 2,000,000 square feet was used in the construction of homes throughout Minnesota last fall and the returns coming in from home owners show that the product is saving these home owners from thirty to forty per cent in coal. The waste parts of logs are shredded and boiled in an alkaline solution to loosen the cementing material which binds the wood fibers together. The fibers are then combed one from another in a beating engine. Now the fibers are rebuilt, but in a different arrangement. First they are fireproofed, pressed partly dry and blown against a traveling wire screen, where they are mixed with cement and cemented, with the fibers projecting in all three dimensions. The fiber sheet is now made up into a "sandwich" with asphalted kraft-paper on either side, rolled up and sold. Similar heat insulators are made from hair, seaweed, flax straw, waste sugar cane, pulp screenings, etc., but none of them, except, possibly, hair is as heat-resistant as the new product made from the fibers of coniferous trees. No balsa wood enters into the composition of the balsam-wool.—*Chem. and Metall. Eng.*, 29:12, pp. 534-36.

**The Skoda Works,** which supplied Austria with most of her guns during the war, and which occupied a position in Austria somewhat analogous to that of the Krupp works in Germany, is now situated, owing to relocation of national boundaries, in Czecho-Slovakia. Where, before and during the war, these shops were bristling with long-range guns, dreadnought turrets and other implements of war, today one sees the construction of locomotives, newspaper presses, milk-separators and similarly peaceful and productive work. The great Skoda works employs nearly twice as many workers as it did before the war. The total yearly capacity of the great factory is 316,000 tons, which is distributed among such items as cast steel, electro-steel, ingots and blooms, cast iron, brass, aluminum, forgings, car wheels and axles, gearings, motor car parts and only about 15,000 tons of heavy ordnance and ammunition. This item is for the small army of Czecho-Slovakia and for that

some newsprint mills jackpine has been handled without previous extraction by the sulfite process with fairly good results, and investigations are under way to find out if high grade sulfite pulp can be produced from this raw material. The greatest progress in the improvement of existing methods has been accomplished as the result of increased knowledge of the chemistry of wood and the chemistry of the reactions which take place during cooking.—*Industrial and Eng. Chemistry*, 15:9, pp. 891-93.

**Industrial Motion Pictures** are coming back into their own. After several years of indifference, chiefly due to unfortunate experiences, manufacturers are again turning to motion pictures. If any industry ever had a deserved check coming to it, it was this one, mushrooming in all directions under the style, "Independent Motion Picture Producers." Anybody with a motion picture camera and a few dollars for film stock could qualify as a "producer." Today they are coming back, but in a chastened and wiser form. The uses for independent motion pictures are almost limitless. A few years ago a few companies used pictures in sales work. Today any number of them send their salesmen out with portable projectors and a picture that actually sells the product. This is particularly true of companies making heavy machinery or intricate mechanical and electrical devices that may be too cumbersome to be easily handled.—*Amer. Industries*, 29:2, p. 12.

**The Ford Motor Company and the General Motors Corporation,** the two outstanding factors in the motor vehicle field, had joint assets on June 30, last, of $1,161,612,412. Strangely enough, there was a difference of only $33,000,000 in their assets, in favor of the Ford Company. These two companies made in 1922 a trifle more than 63 per cent of all the cars and trucks produced in the United States. Their balance sheets gave, expressed in round numbers, the following: Cash, Ford, $231,000,000; G. M. C., $56,000,000. Inventory, Ford, $108,000,000; G. M. C., $115,000,000. Real estate, etc., Ford, $221,000,000; G. M. C., $264,000,000. The G. M. C. capital stock was valued at about $316,000,000, while that of the Ford Motor Company was valued at only $17,000,000. This accumulation of wealth in two decades never has been approached in industrial history.—*Automotive Industries*, 49:11, pp. 534-35.

**Coal Distillation** by the Moscicki low temperature process is a little known but interesting process. It has a high heat economy and produces an oil that has lubricating properties. The Moscicki process consists in heating, or rather reheating, the tail-end part of the gas that is produced in the distillation process to a temperature of about 450 degrees centigrade. Then the gases that are produced by this treatment are used as a heating medium to heat up the mass of coal to a distillation temperature. The essential pieces of apparatus in the installation are a reheater for the gas, a distillation column and a condensing system, the whole being combined with heat exchangers, which economize the quantity of coal and gas that is used in the distillation process. The plant differs in details in accordance to whether the raw fuel is coal, lignite or peat, but the essential elements are the same. The Moscicki process, as used in Poland, is interesting to those plants that wish to produce distillation products from the dry decomposition of coal that are similar in properties to the ones that are obtained by the distillation of peat. It is also interesting to those plants that produce metallurgical coke. By this process there are obtained oils and other products of distillation of high value and, on the other hand, a semi-coke that is mixed with unburnt coal.—*Am. Gas Jour.*, 119:7, pp. 129-31.

## Mechanical Engineering

**The Spring Wheel** is the subject of a long and interesting illustrated article in the *Automotive Engineer*. At the present time the spring wheel is seen mainly through the eyes of numerous inventors. From the drawings and descriptions as contained in their various patent specifications it is possible to derive an impersonal impression of the ideal but as yet non-existent spring wheel. Every road shock represents a certain amount of kinetic energy, which in the ordinary course of events would create in the attacked structure stresses which, if they exceeded the elastic limit of the structure, would permanently deform and eventually fracture it. To prevent this from happening, the kinetic energy entering the structure must be converted into some other form, which must comply with the following conditions: It must not adversely affect the structure; the transformation must be accomplished by simple means, and the shock may be converted into another form of kinetic energy such as vibration, compressed air, or into heat. The solution of the spring wheel problem, therefore, resolves itself into a search for substances or structural elements capable of transferring kinetic energy into heat by the help of friction.—*The Automotive Engineer*, 13:179, pp. 238-42.

**Grooves in Bearings** for efficient lubrication is a question which is now regarded as settled by Dr. T. E. Stanton, director of the National Physical Laboratory, England, and chairman of the Lubricating Committee of the Department of Science and Industrial Research. He states that as a result of his research, using an ungrooved journal and an ungrooved bearing, with castor oil as the lubricant, it was found that steady conditions could be obtained, but that the coefficient of friction was 15 per cent higher than with the grooved surfaces, and that substituting a grooved journal for the plain one did not improve matters. It is clear, therefore, that a system of grooving is essential in order to obtain the minimum friction due to the materials of the surfaces and lubricant employed.—*Am. Machinist*, 59:10, pp. 353-54.

**Friction and Carrying Capacity of Ball and Roller Bearings** have been tested in a novel manner by the Bureau of Standards in conjunction with the United States Navy, using a 50,000-pound vertical testing machine. In making a static friction test on a ball bearing, two balls were used with a pair of grooved races, in order to secure stability in the loaded condition. A plate mounted on two rollers carried the lower ball race, while the upper race was loaded by the testing machine. Between the movable head of the testing machine and the upper ball race a spherical bearing was used. When the desired load had been applied the lower ball was drawn forward by a force exerted through the spring balance. The smallest division on the spring balance represented one ounce. It was found that the starting friction is nearly the same for the two sizes of grooved ball race that were employed, the groove having the larger radius giving the lower friction value. The ratio of starting friction to load increases slowly as the load increases; then much more rapidly. The rapid rise in the friction at greater loads seems to indicate that internal work was being performed on the material of either the balls or races. For reducing the static frictional resistance it is claimed that oil is of little, if any, use upon ball bearings.—*Amer. Machinist*, 59:14, pp. 500-01.

**The New de Lavaud Process** of centrifugally casting iron pipe eliminates the iron flasks and core bars, the sand and clay, and the hay, straw or shredded wood rope used in the old method of casting iron pipe. In the de Lavaud process the pipe is cast in a revolving steel cylindrical mold, the interior surface of which corresponds in every detail with the exterior of the pipe to be cast. Molten iron is poured through a spout extending through the end of the mold, and as the molten iron begins to flow the cylinder develops two motions. One is a revolving motion in which the iron is distributed centrifugally against the inner circumference. The other is a longitudinal movement by which the mold is drawn back, permitting the end of the spout to deliver molten metal along the inner surface of the revolving mold until the spout emerges from the end at which it entered. The centrifugal method insures uniform wall thickness. Therefore it is unnecessary to allow excess metal in order to compensate for variation. The saving in tonnage as a result of the decreased wall thickness is about 25 per cent. Centrifugally cast pipe is said to develop a high tensile strength, and to resist a high interior pressure. The patents on the new method are controlled by a New York company, and companies making cast iron pipe are operating on a royalty basis.—*The Foundry*, 51:18, pp. 727-31.

## Metallurgy

**X-Rays** are already being used to help in making better steel products and to increase our understanding of the structure and properties of steel. X-ray inspection of moderate-sized castings and forgings is now a commercial possibility. X-ray analysis of the crystal structure of steel is at present confined to the research laboratory. It is not

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# Radio Notes

*A Review and Commentary on the Progress in This Branch of Rapid Communication*

**Mexican Broadcasting Station.**—Broadcasting from a 500-watt station, installed by *El Universal*, a local newspaper, was inaugurated during the latter part of September. It is said that this station can transmit to the southern part of the United States, Central America and Cuba, and it should have an important bearing on the demand for radio receiving sets throughout Mexico.

**A Variable Loop in the form of a curtain** shade has made its appearance. The loop consists of a roller, a curtain support and the turns of wire placed on the curtain support. When fully open this loop is quite large and serves not only for broadcasting reception but for higher wave lengths. By opening the shade member more or less, any desired inductance can be brought into play for the active loop, thus making for the greatest possible efficiency in a loop receiver. The device is provided with a wall bracket and swivel so that it may be pointed in any desired direction, or placed on any door in the house.

**Photoelectric Triodes.**—Three-electrode vacuum tubes containing vapor of alloys of alkali metals, having low ionizing potentials and the characteristics of a photoelectric cell, give remarkable results as detectors with 10 volts on the anode, according to the *Proceedings* of the Institute of Radio Engineers. These tubes are at least three times as sensitive as the usual gas content tube and in addition are quite sensitive amplifiers. The photoelectric properties cause this tube to function quite well with zero plate voltage. In this case the source of energy is probably the luminous and non-luminous radiation from the filament.

**Automatic S O S Alarm.**—The apparatus described in a recent issue of *Radioélectricité* consists of three main portions: an amplifier, a wireless receiving relay, and the S O S selector. The amplifier takes the place of the crystal in the ship's ordinary wireless receiver and magnifier of the received signals, rendering them suitable for operating the receiving relay. The S O S selector itself, which is controlled by the receiving relay, operates on the chain relay system. There are two relays arranged to discriminate between a dot and a dash, then a series of nine relays corresponding to the dots and dashes of the S O S signal. A canceling relay is incorporated, which restores the selector to its ready condition if the correct sequence of dots and dashes is not received, while the intervals between the dots and dashes are checked by a further delay action relay.

**Radio Forgery and the MacMillan Expedition.**—Since MacMillan, the well-known arctic explorer, went north on his present expedition there have been three instances of radio forgery where some amateur with a radio telephone transmitter has gone on the air and impersonated MacMillan. For instance, the Philadelphia *Public Ledger* recently published an account to the effect that one of the officers of a Philadelphia trust company had, at his summer home in the Pocono Mountains, distinctly heard MacMillan broadcast a message by voice. In truth and in fact, MacMillan has no voice transmitter and uses nothing but code in sending back his messages. MacMillan has been coming through right along with the radio telegraph transmitter used for this present expedition. The American Radio Relay League members are straining every effort to keep in touch with MacMillan, despite the great distances involved.

**Knocking Noises and Statical Discharges in Telephones.**—The cause of knocking noises in telephones has hitherto been attributed to the membrane buckling or knocking against the pole-pieces of the permanent magnet, according to D. Bähr, a German engineer. That the source of the knocks is not in the diaphragm is shown by removing the diaphragm altogether, when, although speech is but very faintly heard, the knocks are still strongly heard. The cause of the trouble is found to be statical discharges, and reference is made in this connection to three methods by which sounds may be produced without the diaphragm, by electrodynamical actions between the turns of the windings, by the sound given out by iron on being magnetized, and by the condenser action between the telephone and the shell of the ear. The trouble is largely overcome by arranging a connection between the ear and ground of considerably less resistance than that through the body between the ear and the fingers.

**Radio-Acoustic Marine Direction Finding.**—A description of a means of locating the position of a ship at sea by the emission of a radio "dash" simultaneously with the firing of a small charge in the sea, is contained in the *Proceedings* of the Physical Society. A station on shore records the arrival of the radio signal, and also of the explosion wave at a number of hydrophones suitably disposed in known positions on the sea bed. The times of travel of the explosion wave, and hence the distances from the charge to each hydrophone, are indicated by an Einthoven galvanometer photographic recorder. Although great accuracy is attainable, for navigational purposes it is sacrificed to speed—it being possible to give a ship her location within a radius of half a mile, inside ten minutes from receiving her request for a position. This method has been thoroughly tested under service conditions and has been found absolutely reliable. A 9-oz. charge can be located at a distance of 40 miles. In hydrographical survey work the method has been tested successfully in fixing accurately the positions of certain buoys and light vessels. The possibility of screening and distortion effects produced by sandbanks has also been investigated.

**Broadcasting in Shanghai.**—Several attempts have been made at Shanghai to establish broadcasting stations, the first being that of the Radio Corporation of China, whose equipment was operated for a short time on the roof of the Robert Dollar Building. A little later the Electric Equipment Company installed a 50-watt set on top of its building, the station being used ostensibly for experimenting and for demonstrating radio sets to its customers. This set is still in service. Broadcasting programs were next offered by the *Evening News*, a local paper, and by the Wing-on Company, a large department store, which recently installed a station, but the right of these to continue has been questioned by the Chinese Ministry of Communications. Development of radio broadcasting in China has been retarded by the fact that the importation of wireless apparatus was prohibited by the Chinese Government. This embargo was based upon an article which states that all "telegraphs and telephones, whether with wire lines or wireless, are called electric communications," and another article states that "electric communications shall be operated by the Government." But so keen is the local interest in radio that radio broadcasting must soon be in full swing on a satisfactory basis.

**The Pallophotophone as a "Pick-Up."**—The pallophotophone is designed, by means of a beam of light, to convert sound vibrations into corresponding electrical oscillations. This is brought about by causing a variation in volume of a beam of light entering a suitable light-sensitive cell, to correspond to the sound waves produced. The light from a special incandescent lamp is focused by a spherical lens on to a small mirror, and is reflected through a cylindrical lens on to the light cell. When the sound waves enter the mouthpiece the diaphragm and mirror are made to vibrate, causing the reflected light beam to move horizontally to and fro across the opening, thus varying the light entering the cell. This, again, varies the current flowing through a resistance, producing a change of potential which may be applied to the grid of a pliotron and amplified to operate any suitable electrical device. The vibrating element is described in detail in a recent issue of the *Journal* of the A. I. E. E. A movement of the diaphragm of only 0.0000005 in. is necessary to reproduce satisfactorily speech or music. The moment of inertia is extremely small. The method of recording and reproducing sounds from a photographic film is given, and the paper is illustrated by various diagrams and photographs of the apparatus.

## Scientific American Digest

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unreasonable to believe that the day is coming when the specifications for steel will call for a particular X-ray pattern as well as a particular chemical composition.—*The Iron Age*, 112:13 and 14.

**The Sorbitic Treatment for Steel Rails** is a kind of heat treatment which permits the production of a wide range of variability in tenacity, ductility and hardness for any one given carbon percentage, rather than by a variation of the percentage itself. While the increase of carbon percentages gives increased hardness, they give reduced ductility and resistance to shock, so that at about 0.70 per cent carbon this limited resistance to shock becomes a serious risk. But the range of physical properties obtained by the sorbitic process is greater than that obtainable by variations in the carbon content. The arrangement of the carbon in the iron which gives the best combination of hardness and toughness makes a mineral called sorbite—that is, sorbitic steel. The rails are taken as they come from the mill at a temperature above the critical range and cooled through such a range of temperature and at such speed as shall arrest and hold the crystalline structure at the exact point at which the sorbitic structure of the carbon and iron is attained. This treatment has been given to guns and other special forgings for years, but the treatment of large numbers of steel rails becomes a far larger and more difficult problem.—*Railway Engineer*, 44:524, p. 344.

**Dirty Limestone** having caused complaint from blast furnace operators, a plant has been installed for cleaning the stone. With a current of water, the stone enters a scrubber which is a revolving cylinder thirty feet long and five feet in diameter, driven by a motor. On the inside of the scrubber is a series of fins riveted to the casing for the purpose of forcing the stone forward to the discharge end of the scrubber. The revolving action of the cylinder, throwing stone against stone, tumbling over and over, and being forced forward, puts all particles of dirt into suspension in the water, and the latter is washed away.—*Iron Age*, 112:12, p. 736.

**Zirconium in Steel** is the subject of a paper by Alex. L. Field, New York research metallurgist, which is reviewed in *The Iron Age*. It is shown that zirconium combines chemically with oxygen, nitrogen and sulfur, in the order given, and is able to neutralize the embrittling effect of phosphorus in whole or in part. A relatively small addition of zirconium makes possible the satisfactory rolling of steels containing as high as approximately 0.30 per cent sulfur, which without zirconium treatment break to pieces on the first pass through the rolls. Plain carbon steels treated with approximately 0.15 per cent zirconium exhibit in the heat-treated condition tensile properties that closely approach those of alloy steels, especially in that range of drawing temperatures between 300° and 450° centigrade. Zirconium reduces the total oxygen content of steel and operates to prevent the occurrence of emulsified slag and "banded" structure. Zirconium combines with the nitrogen dissolved in molten steel to form a crystalline microconstituent of a bright, lemon-yellow hue, which is in large part removed from the steel while the latter is still molten. Zirconium forms, with the sulfur content of steel, an acid-insoluble sulfide and eliminates from high-sulfur steels the last traces of iron sulfide.—*The Iron Age*, 112:10, pp. 607-08.

**Electric Welding of Cast Iron** was solved in France in 1920. Gray iron electrodes are used, which carry a high percentage of silicon. Though, of course, both this and the added carbon burn out during the melting, there is sufficient in the original composition and the added carbon adequately to compensate for the loss. A proper weld is established because the cast iron remains liquid for a sufficient length of time, and during this period there is a thorough mixing taking place, due, no doubt, to gas expulsion. The carbon, added as either graphite or charcoal, quite easily dissolves in the pool of metal because of this "boiling action," and the weld, on cooling, consists of gray iron. To control the carbon in the liquid weld metal, the cast iron electrode is encased in a mixture containing a high percentage of graphite or charcoal of suitable thickness, either by grooving the rods or making them hollow for that purpose. Or carbon can be added mechanically, always bearing in mind that the quantity must be sufficient to replace that burnt out by the arc. The grain of the deposited iron is of

**a finer character than ordinary cast iron.** Neither blowholes nor hard spots have been found in the weld. The parts to be joined must be heated sufficiently to prevent the first-deposited metal from freezing too rapidly and to allow the carbon time to dissolve. At least 600° centigrade should be attained to start.—*Foundry Trade Jour.*, 28:366, p. 151.

**Metals Produced in the Electric Furnace** have, for different reasons, been considered to have some properties superior to those produced by other methods. Research and discussion in this direction suggest that we shall find results which will enable us to control and improve a metal for more pronounced mechanical effects, due to a knowledge of the electrical and magnetic phenomena. The nature of this control is based on the assumption that molecular structure and crystal growth are a bonding due to electro-magnetic values. The regulator of the electric current used being an easy matter, it appears that radical improvements in electric furnace metals may be expected from the development of molecular electrical effects in the molten state.—*Canadian Chem. and Metallurgy*, 7:8, p. 196.

**Stainless Steel** was discovered by Mr. Harry Brearley in the course of research into the cause and cure of erosion of the bore of large guns. The discovery had just been launched on a manufacturing basis when the war broke out, and during the war all available supplies of stainless steel were taken up by the fighting services, very largely for aero engine valves. With the notable exception of its application to cutlery, very few engineers are aware of its great value as an engineering material. Statements made to the effect that it is difficult to machine, unsuitable for highly stressed articles, unreliable as regards its stainless and rustless properties, and prohibitive in price, need not be taken too seriously, as it has invariably been found out that when all the facts respecting the prospective use of the material have been placed before the steel manufacturer, and the steel supplied has been treated in strict accordance with his instructions, the results have been perfectly satisfactory. The rustless and stainless properties of the steel are to a certain extent disturbed by rough machining, and it is always advisable to finish with a fine cut, or, better still, by grinding. Pickling is employed for the removal of the scale after heat treatment, being preferable to sand-blasting. —*Foundry Trade Jour.*, 28:365, pp. 131-35.

**Trend of Research in the Non-Ferrous Metal Industry.**—The amount of engineering and scientific thought now applied to these industries is probably fifty times as great as in 1900, and ten times as great as in 1912. A recent survey revealed the fact that over sixty manufacturers within the non-ferrous industries maintained research departments and laboratories in 1920. The use of pyrometers is increasing rapidly in all branches, as well as that of testing instruments of all sorts—particularly the microscope. Well defined standards for products are also rapidly making headway, stimulated by the splendid work of the American Society for Testing Materials and the U. S. Bureau of Standards. Another indication of the new research spirit is the increasing willingness and even desire on the part of individual companies to exchange information with others and to undertake cooperative research work.—*Industrial and Eng. Chem.*, 15:9, pp. 895-97.

### Mining

**The Soft Coal Lost in Mining** equals more than one-third of the total, according to the United States Coal Commission. The principal causes of these losses are due to coal left on the roof and bottom, coal lost in pillars, coal lost under buildings, railroads and boundaries, coal lost in preparation and handling, and by minor causes. Of these losses, about 40 per cent is unavoidable, but nearly 60 per cent is considered as avoidable. The specific causes for these avoidable losses include improper methods of mining, and careless engineering; careless cleaning of the coal in the mines or at the tipple; losses due to excessive blasting; poor methods of transportation, including cars that spill coal. One large cause of loss is due to leaving pillars to keep the surface intact where backfilling methods might be employed. The greatest loss in mining is in room entry and panel pillars, this loss varying from 5 to 45 per cent, of which from 3 to 36 per cent is avoidable. Sometimes pillar-drawing is done more or less carelessly, and stumps containing from 30 to 100 tons are left untouched.—*Report of U. S. Coal Com.*, Sept. 1923.

**The Automatic Centrifugal Pumping Outfit** no doubt will revolutionize mine pumping. In the bituminous coal field it is asserted that an average of about two tons of water is pumped from the mines per ton of coal mined, while in the anthracite field the ratio is about eleven tons to one; in some places the figures run as high as fifty to one. The idea of developing an automatic centrifugal pumping outfit was first suggested in May, 1922, and tried out with success in June of the same year. Since that date many automatic centrifugal pumping outfits have been laid out and ordered and some are already in operation. The new system makes possible remote control of the pumps, reduces labor costs for pump operation, simplifies keeping a mine dry during temporary idleness, and in the event of strikes makes possible the operation of a large number of pumps with only a small amount of occasional inspection.—*Coal Age*, 24:11, p. 392.

**Excessive Underground Temperatures** in the mines of Butte, Montana, the world's largest mining camp, have been reduced, in some instances, as much as 10 to 15 degrees, through the application of scientific ventilation methods, according to Bulletin 204 issued by the Bureau of Mines, which describes the investigations of two scientists of the Department of the Interior. Lower mine workings, with rock temperatures of more than 100 degrees, previously unworkable, have been converted into comfortable working places. Butte mining companies now believe that in case their ore bodies reach to a depth of 5000 feet or over, with rock temperature of 115 to 120 degrees, they will be able to obtain for such deep workings an atmosphere which will allow safe, comfortable and efficient work. The mining companies of the Butte district have recently made great progress in ventilation betterments. The dust situation has been largely eliminated by the adoption of wet drills for practically all drilling, by the introduction of water lines for sprinkling to practically all working faces in many mines, and by increasing the flow of air to working places. —*The Am. Zinc, Lead and Copper Jour.*, 13:5, pp. 3-4.

**Carbon Monoxide in Mines,** most insidious and deadly of poisonous gases, may be detected and means have been found by which it is possible to discover within three minutes the extent to which a person has been affected by carbon monoxide gas, through the extent of poison saturation of the blood. Formerly it took approximately from 24 to 48 hours before diagnosis could be made of such cases, either in hospitals or in well-equipped laboratories with the services of a well-skilled organic chemist. The test is effected through a simple and inexpensive instrument which may be carried in the pocket and which requires no special training for its operation. Many human lives are expected to be saved by the general adoption of this method of detecting gas poisoning, particularly in the mining industry, as well as in other fields where dreaded gases are a menace. With this quick method of diagnosis it is possible to institute promptly the proper emergency treatment. Because of the possible exposure of citizens in all walks of life to its deadly influence, the new instrument for detecting it in the blood is expected to be in universal use among the physicians within the near future.—*The Am. Zinc, Lead and Copper Jour.*, 13:5, p. 9.

**Two Important Developments** have recently been made in rendering the concentrates from the froth-flotation system of coal washing more suitable for industrial purposes. These concentrates are finely divided coal particles mixed with a large quantity of water, and the concentrates must be separated from the water with which they are originally in such close association. The first method consists in agitating the pulp and aerating it. Oil or tar is added to coat the particles and make them flocculate together, after which they are separated from the water by draining or filtration, without being compressed into blocks or briquets. In the second process the pulp of coal and water is agitated with a binding agent consisting of pitch which contains naphthalene or phenanthrene so as to coat and flocculate the particles as in the first method. On introducing the pulp into a press and subjecting it to a pressure of two tons per square inch, an excellent briquet is produced, substantially free from moisture. The briquets are hard and durable, and become harder with time, and it is also found that the naphthalene volatilizes out of them.—*Coal Age*, 24:8, pp. 277-78.

## With Fire and Fraud

(*Continued from page 383*)

quickly bringing about a conflagration in which the innocent cat was herself destroyed. It is pleasant to relate that Schwartz and his son were both sent to prison for long terms. But other times, other cats and other trainers.

It is manifestly impossible to make a list of all the mechanical and other devices used for producing profitable fires. Had the various insurance companies, the credit associations or the police kept collections of all such instruments and mechanisms there would be material for a museum. The Bureau of Combustibles in the New York Police Department must alone have had enough specimens to fill a great gallery.

Criminals sooner or later come to realize the frailty of mechanical attack. Society has too many weapons for defense, too many officers for detection, too many inventors at work. Naturally, the cleverest lawbreaker turns, wherever he can, to some scheme, some mental fabrication, to take the place of a machine. Accordingly, the arson professionals have developed a technique of fire setting that may be understood from the story of Mr. Hyman Marks, general merchant and adventurer in blazes.

A year ago Mr. Marks opened a drygoods and notions store at Blank, Wyo. He also opened communication with eastern jobbers, told them what an honest man he was, promised payments at a stated time and enclosed in each letter an order for goods. Many of the credit men of the firms addressed were eager to capture a little new business and took their chances, seeing that the new man's requisition was small. Ergo, Mr. Marks got a good deal of merchandise on credit. To do him all honor, he paid for it at the end of thirty days and enclosed with his check a somewhat larger order, which the jobber again filled, in each case. Marks had established himself as honest and "good pay."

When time came for the second payment, it too was made promptly and a third and still larger order was sent along with the remittance. I suppose I need not go further into the details of this ancient method of working up a credit.

Marks added a thrill to the old game by opening a second store at Where, Wyo. He informed all of his jobbers of this move, saying that business was good but that he would improve it by opening a second outlet to reach a new body of buyers. However, he intended to do all buying through his first and main store. So saying he enclosed a very large order. The jobbers saw what Marks had written, set him down as an intelligent and progressive man—and sent him the goods.

Now the fun began. Marks took the merchandise out of the cases at his main store in Blank, repacked the cases with oil soaked excelsior and large stones, and shipped these fakes to his place in Where. At the same time he made a display of real merchandise and the stuffed cases at Where and took out $15,000 worth of fire insurance. As soon as the policy had been written and the premium paid, the thing was ready to revolve.

Marks shipped back to his Blank store whatever valuable stuff there had been at Where. Then he secretly stripped the store at Blank by removing his goods a little at a time and secreting them in Denver. Just before Christmas, both stores were practically empty, except for odds and ends of poor stuff and a great many cases and empty boxes.

On a bitter winter night, when it was certain the firemen could work only with the greatest difficulty, the store at Where burst suddenly into flame and was burnt to an ash heap before the fire fighters could get into action. Indeed, they had all they could do to keep the blaze from spreading and congratulated themselves on saving their town.

While this was happening, Mr. Marks was, of course, in Blank. He collected his insurance, wept over the fact that it was not half enough to cover his loss, fixed the books at the Blank store to show the disbursement of the insurance money to relatives and friends who had lent him cash on notes, and then closed the doors of this shop as well. His creditors swooped down on him but could find neither goods nor any fault in his lamentable story.

Then Mr. Marks disappeared.

Two weeks later a suave and well dressed fellow rented a store in one of the principal business streets of Denver, gave his name as Simon Poor and prepared to open in dry-

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# The Service of the Chemist

*A Department Devoted to Progress and Achievement in the Field of Applied Chemistry*

Conducted by ISMAR GINSBERG, Chemical Engineer

**Uses of Manjak.**—Manjak is a substance which is obtained in the island of Trinidad, and in but few other places on the earth. It is a mineral substance and has a number of uses which are rather interesting. In the first place, a lubricant is manufactured from it. Thread grease for pipes and for use in rotary drilling, making absolutely tight connections against grit, water and mud under high pressure, is made from it, as well as a lubricant for gear cases, sprocket wheels and roller bearings. If the manjak is too heavy, it can be cut with kerosene. A hard flux is also made from it. It protects surface and underground piping or casing against corrosion and hydrolysis. It can be used as a roofing material and for sealing up leaks in tanks and for caulking seams. It saves condensation on steam lines and boilers. It prevents pitting. To protect pipes or casing, the flux is liquefied by heating and, as it cools off, an equal measure of kerosene or crude oil is added. The flux is applied by brushing, dipping or spraying. A jet black paint is also made from the manjak gum. This paint dries quickly, giving a tough, unbreakable covering to protect hot and cold surfaces, smokestacks, undersides of motor cars, etc. It may be used as an anticorrosive paint for ship bottoms. This paint is prepared ready for use. The paint is cut with a little gasoline or white spirits. The paint can be applied easily and does not drag on the brush.

**Arsenical Fungicides.**—A study has been made of various arsenical fungicide and insecticide preparations on the market with a view to determining the relation between chemical composition and the effectiveness of the insecticide. It was proven that there is no general relationship between the chemical constituents of the insecticide and the toxicity of the insecticide. It is always necessary to carry out both a chemical and a toxic investigation of the insecticidal or germicidal preparations. See U. S. Dept. of Agriculture, Bulletin No. 1147, for further details.

**Transparent Artificial Horn From Casein.**—The ordinary products that are made from casein are opaque and cloudy even when dry. This milky appearance of the casein compositions limits their use. A new process has been developed in which the casein compositions are made in transparent form. The casein or casein solution is mixed with an aqueous solution of basic salts of phosphoric acid, boric acid or sulfurous acid. These solutions are in such concentrations that the precipitation of the materials causing the cloudiness takes place. The liquor is separated from the precipitate and worked up in the usual manner. Ammonia, alkali or alkaline earth hydroxides can be added to the precipitating salts to good advantage. The precipitated products can also be used for making compositions. For further details see Kunstoffe, 1923.

**Furfural as a Paint Remover.**—Furfural is the aldehyde of furfuran and is obtained from the processing of corn cobs. The corn cobs and water are placed in an autoclave and steam at about 135 pounds pressure is admitted and the mixture is permitted to digest for about two hours, after which the furfural is blown off by steam, condensed and collected. The furfural is then separated from the water by distillation. The yield is about 120 pounds of furfural from one ton of corn cobs, or approximately six per cent. Furfural has an agreeable odor and boils at a temperature above 100 degrees C. Its boiling point is the same as that of turpentine. This makes furfural a much less dangerous substance than some of the solvents that are used in paint and varnish removers. It also obviates the necessity of weighting the solvent with wax, as it evaporates slowly enough to do its work thoroughly. Furthermore, it does not injure the surface underneath. When smeared over a surface it evaporates after a while, but it shows a tendency to form drops. This disadvantage may be removed by the addition of 20 per cent of solvent naphtha. By the addition of wood oil the viscosity of the furfural is increased. See reports published by the United States Paint Manufacturers' Association.

**New Process of Glass Melting.**—According to a report delivered to the London meeting of the Society of Glass Technology, a new glass-melting process has been devised which, it is claimed, is easy to operate and cheaper than those in common use. The finely pulverized glass mass, which is fine enough to pass through a 60-mesh screen, is placed in a cyclone tank, into which the heating gases are introduced. The glass particles swirl around and move towards the walls of the tank and when they come in contact therewith they are melted at a most rapid rate.

**Cantharidin From American Beetle.**—Cantharidin, an important drug which up to the present time has been obtained mainly from the Spanish fly, has been successfully prepared from an American beetle. This species of beetle is found in large quantities in Texas, Kansas and the adjoining states. The Bureau of Chemistry has recently made an investigation into this matter and has found that the American beetle contains from 0.6 to one per cent of the active principle, cantharidin, and from four to five per cent of cantharidin salts. The eggs were found to contain large amounts, the heads very small amounts and the wings no cantharidin at all. This proves that the American beetle contains more of the drug than the Spanish or Russian fly.

**Pure Glycerine.**—Austrian Patent No. 88,188 is concerned with a process for the manufacture of pure glycerine. Liquids which contain glycerine are treated with lead compounds, such as lead oxide or lead hydroxide. The result is that the lead is precipitated in the form of lead glyceride. This compound is then heated with water under pressure or with the addition of alkali. A pure glycerine is obtained in this manner.

**Desiccating Copra.**—The *Oil, Paint and Drug Reporter* recently published a description of a new and simple process of desiccating copra with the aid of sulfur, a process which is being practiced in the Philippines. Copra is dried coconut and is shipped to this and other countries in a desiccated condition. It is then used for the extraction of the oil, coconut oil. As copra is apt to decompose during shipments, this treatment with the fumes of burning sulfur is a great improvement in the method of handling this product. About five kilograms of sulfur are used for every 1000 kilograms of the nuts. There are many advantages which are claimed for this process. The copra is preserved and bleached by the sulfurous vapors. The product is very white. There is no loss of oil in the process of sulfuring and desiccation. It is also claimed that this process makes it possible to obtain a very uniform product, that a greater yield of copra is obtained from a given weight of the nuts than by any other process, that the copra keeps better, is cleaner and that the oil that is extracted from this sort of copra is practically colorless, free from rancidity and of a quality comparable with that of the best oils manufactured. There are two disadvantages—the cost of the sulfur and the longer time spent in the desiccation of the copra. The increase in cost due to the sulfur is very small and is probably more than counterbalanced by the additional yield of oil obtained from the copra. The increased time of desiccation is compensated for by the superior grade of coconut oil that is obtained from the copra treated in this manner.

**New Book-Covering Material.**—A new book covering material which is superior to most materials that are used for this purpose is described in the *World Paper Trade Review*, June 1, 1923. The basis of the new material is a discovery made in connection with rubber technology, whereby it was found that by exposing rubber alternately to the action of two gases for about one-quarter of an hour it was vulcanized in the cold. The book-covering material is made with the aid of various waste materials, such as leather buffings and shavings ground up, sawdust, cork dust and shoddy, all of which

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## Service of the Chemist

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are mixed intimately with the rubber. A plastic solution is formed in this manner which can be worked with aniline dyestuffs into any color and form. The result is said to be more durable than leather, capable of much more diversified treatment and much cheaper.

**New Tests for Fibers.**—An interesting article published in the *Textile World*, Aug. 18, 1923, deals with a method of testing fibers to tell the difference between flax and hemp in the woven cloth or fabric. Various microscopic tests have been employed, but these are quite difficult to carry out. A much simpler method has been developed of telling the two fibers apart. If a single wet fiber is held with the free end toward one, flax and ramie will twist in the clockwise direction while drying, but hemp and jute will twist in the opposite direction. No special apparatus is required and a few fibers carefully selected to represent the whole will give the indication. The new test will work with fibers in any stage, freshly retted straw, scutched flax, green or bleached yarns, or even beetled and finished cloth. For convenient working the sample is put into water and the fibers are separated as nearly as possible to actual single fibers. On removing one at a time for observation there may be a slight twist due to wetting, but almost at once there is a greater opposite twist due to drying. The latter is the desired indication.

**Zinc Chalk Pigment.**—French Patent No. 546,646 is concerned with a new white pigment which is claimed as a substitute for white lead, with superior properties. The new pigment is produced by working together first 25 kilograms of carbonate of lime (chalk), two kilograms of potassium alum and two to three kilograms of gelatine or similar material, with three liters of water. Then there are quickly added 100 grams of an alkali, 20 kilograms of linseed oil and 47 kilograms of zinc oxide. The mass is kneaded for half an hour. The paint is said to possess anti-rust properties superior to those of red lead.

**Tannins from Coumarone Resin.**—The salts of coumarone resins are being used as tannin materials, and a process for making these salts is described in British Patent No. 173,757. The process consists of making colloidal solutions of the iron, chromium or aluminum salts of the resin by treating the aqueous solutions of the sulfonic acid with an oxide, hydroxide or carbonate of the aforementioned metals. The sulfonic acid is made by treating the resin with four times its weight of fuming sulfate acid.

**High Heels Rot Pavement.**—Paris pavements are very largely of wood and deteriorate very rapidly. When the cause was sought by the city engineers, it was found that the heels of women's shoes were largely responsible. The feminine shoe heels are so narrow at the base as to be almost points, and these penetrate the wood, punching holes in which the water settles, thus rotting the paving.

**Grass Towels in Petrograd.**—Bundles of dried grass and flax are sold in the streets near the public bath houses, to be used as towels by the bathers. They cost but a penny or so, and are thrown away after use. Foreigners take their own towels, for while the grass serves its purpose well enough it is found to be too ticklish for their tender skins.

**Musk Trade of China.**—The Chinese musk export trade is practically controlled by four large firms in Shanghai, Tachinglu, the principal point of collection, and Chungking, the chief port of original export of this commodity. There are, however, writes the United States Vice-Consul at Chungking, numerous minor firms engaged in supplying the local demand. In spite of the unsettled political conditions along the Szechwan-Tibetan border, the export of musk from Chungking has increased somewhat since the close of the late war, amounting in 1920 to about 3600 pounds, valued at 577,079 haikwan taels (about $700,000).

**Keeping Attar of Rose Pure.**—Much of the attar of rose comes from Bulgaria and the sophistication of the perfume since the war has given deep concern to the government, which has offered 1,000,000 levas (we do not know how much this represents in real money) for prizes for a process to discover adulterants. Essence of geranium has been used to debase the perfume. This has proved very detrimental to the trade. It has not only weakened confidence but has a disastrous effect on prices as well.



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## With Fire and Fraud

*(Continued from page 437)*

goods and notions. Once more the credit building game was worked till Mr. Poor owed easy-going eastern jobbers $31,000. He closed his shop and offered a settlement of about 10 per cent.

But the limit of tolerance had been reached. Investigators were put to work. One of them got the confidence of a jealous relative of the desolated Poor and caught the information that Poor had once been in Blank and Where, Wyo. The investigator sniffed the mountain air with cold suspicion and rushed off to Wyoming, where he soon found that Marks and Poor were one and identical. He said nothing and returned to Denver in what seemed dejection. But a few nights later he appeared at the residence of Mr. Poor with a search warrant, procured under the pretext that Poor was suspected of bootlegging. A barricade of the stairs leading to the garret was smashed and there was found, safe and clean, all the goods from the Denver failure and some from Blank and Where.

Just after the anniversary of Bethlehem is, by the way, the favored season for profitable jobs by fire. The holiday selling is over. The best goods have been turned to cash. The shelves are decked with empty boxes. A little fixing of the books, a little gasoline and a nice little arson bomb! It is the crooked merchant's pleasant manner of sending his Christmas greetings to his creditor and his insurer.

Perhaps, O patient and magnanimous reader! as you sit with a roving eye upon these pages in the gusty nights of December, some such Yule fires will be burning in your town.

## Another Mediumistic Failure

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brought into view in the most casual manner. I felt confident at this moment that the thing was accomplished."

Dr. Prince's confidence was such that, as the circle shifted, he whispered to Mr. Ingalls that we should have results within a few minutes. It is to be remembered that the conjurer is not bluffing when he tells us that the hand is quicker than the eye. It really is. Another performer or a skilled observer, watching the sleight-of-hand artist at work, will not actually see him do his stuff; but he will usually see how and when he does it, by recognizing the necessary false moves and the necessary opportunities. This is what Dr. Prince saw, and it is all that any observer could hope to see, if the performer were a competent one.

The medium has a good dramatic sense. She now withdrew to the stone table in the rear of the garden and, reclining on this for a moment, she surveyed the audience speculatively. Even at the moment her attitude impressed several sitters as one of confidence. She returned to the work table and called the entire company close about her for a supreme effort. She had Dr. Carrington place a hand at the back of her neck, and she grasped Mrs. Kirby's hand with her own left, across the table. Using Dr. Prince as "battery" for the first time in any sitting, she went through a series of mild convulsions, fell back toward her chair (but missing it, so that she had to be caught and placed in it), and moaned, "Look at the cards! Look at the cards!"

Sure enough, three cards were found written upon. The announcement to this effect caused a huge sensation, and all the sitters surged about the table. The medium could have substituted anew any further cards which she might have had at hand while this furore was going on, without the least probability of detection. In fact, after an exact repetition of the previous procedure as regards hands and convulsions, two further cards were found. A third attempt was about to be made, when the medium gave a little shudder and announced a clairaudient message from Effie to the effect that no further cards would be written today. To those unfamiliar with the term, this means that Effie spoke to the medium, who can hear her though nobody else can. It signifies an abnormal auditory impression, analogous to the abnormal visual one implied by the word clairvoyant. Effie's verdict was accepted without question, though I fear she is not altogether reliable; at the hotel after this Bayside sitting, she came to Mrs. Y and told her she was going to win our award.

The most serious criticism that can be offered of the medium, on general grounds and apart from the direct and indirect evi-

dence adduced above, is that of inconsistency. I have already given one instance of this in her inability to stick to one story about the location of the writings in the pack. Equally unsatisfactory was the matter of "soft" colors. We could get no more intelligible statement than this. She was certain that yellow was not "soft," but in the next breath indicated that the real objection to it was that a message written in it would not be sufficiently legible. This, by the way, is correct; the philatelist finds it often impossible to distinguish between two minor varieties of a yellow or even of an orange stamp. On the basis of the sittings, it would appear that "soft" means "red"; flowers of any other tone were ignored by the medium whenever possible. A test which she applied at the first sitting only was to crush the petal, and note whether a stain remained on her finger; if it did, the color was satisfactory.

The medium was a tremendous talker. She had several ancedotes which she told repeatedly; and at every opportunity, in season and out, she told us at length of the wonderful things she had done at other times and places. This, by the way, was such a marked feature of our sittings of last May, with "Mr. X," that at the time we coined a phrase, "when we weren't looking," to define the conditions under which these marvels were produced. Mrs. Y, incidentally, is acquainted with Mr. X and did what she could to make us wonder whether we had not made a mistake in his case. Of no bearing on her own case prior to our verdict, I think this is significant in retrospect.

The medium's fluent conversation, in itself, would perhaps not have been objectionable; she must do something, if she be genuine, to "get out of herself" and to destroy self-consciousness. But the manner of her talking was very objectionable. Again and again, when Dr. Prince, Dr. Carrington, Mr. Lescarboura or I was watching her hands or engaged in some other definite bit of observation, she would deliberately address her next remark to this observer, in such a way that his every instinct was to transfer his gaze to her face for the purpose of the conversation. This looked altogether too much like a trick.

The judgment of one inclined to accept the mediumship, *a priori*, as genuine would have been that the three initial failures were due to the lady's inability to relax mentally and get out of herself. Her mind was extremely active, and she led the conversation rather than following it or letting it run its course unhindered. Often Dr. Carrington pointed this out to her, in response to her complaint that she couldn't relax, couldn't forget herself. She remarked the general tenseness of the atmosphere—a complaint that was probably justified the first day, but hardly on later occasions. On the other side of the picture, the sitters were unanimous, after the second and third sittings, that Mrs. Y's whole attitude had been extremely perfunctory—that of one who has no slightest expectation of getting results. This was not noted at the first seance—perhaps because the necessity for getting away with some of the cards kept her interested. At a fifth, and unsuccessful, sitting held in our offices again on the 18th, her lack of interest and her evident knowledge that nothing was to happen were flagrant.

Mrs. Y has, at home, an extraordinary collection of documents attesting the faith in her genuineness felt by the signers. She brought a portfolio of these with her, and, in spite of our explanation that it hadn't the slightest bearing on our consideration of her case, insisted upon leaving it with us and upon our reading its contents. Equally, and against the same remonstrance, she insisted upon telling us about several occasions on which she had been charged with fraud, and explaining these charges away. In particular, the national organization of Spiritualists has repudiated her, bringing exactly the same accusation that we bring; and she used up a lot of time informing us of this, and giving her version of the affair. There was also an extended narrative of some harrowing experiences which she had had at the hands of a committee of magicians, which she insisted upon giving us twice, in great detail.

As we went along, Mrs. Y. devoted more and more of her patter to expressing her appreciation of the eminently courteous and proper treatment which she was getting at our hands. We, of course, went out of our way to make this statement line up with the facts. We met the lady once after our examination of the Bayside results had been completed. She was extraordinarily well pleased with herself and with us; she had been

among those who didn't know exactly what "prima facie" means, and she was mentally spending our $2500. She gave me a most enthusiastic testimonial as a gentleman. I believe she has since reversed herself on this count.

From her advance statements one gets the impression that Mrs. Y's procedure is quite fixed. Once in the seance room, one learns differently. She uses the flowers always, as advertised, but she does not confine herself to them. She wears a vast collection of jewelry, and more often than not she places some of this among the cards—an enormous yellow bracelet being her favorite for such use. Under these circumstances, she says, the writings are apt to come in gold or silver; and she states that once, when the cards were laid momentarily on a mahogany table, they came in a mahogany tone. She is always careful to make the reservation that she is talking about the color alone; that she doesn't know what the writings really are.

This interpolation of the jewelry into the case is, of course, highly objectionable, since it relieves the medium of all necessity of knowing, or guessing, or forcing, the decision as to the color of the flowers to be used. Another unadvertised deviation has to do with her manipulation of the cards. Though she uses a "battery" more often than not, she often omits this feature; and she does many unorthodox things with the cards. She puts them to her own head, she parades about the room with cards in her right hand and her left extended ostentatiously, she sits at her table and fingers the cards and turns them over and fairly plays solitaire with them. Often she asked us to examine them for writing when they had been subject to no treatment which a rational psychic believer would regard as likely to produce writing upon them. At Bayside she threw a dozen or so cards into the nasturtium bed and insisted that they stay there till the end of the sitting, to see what they might develop. Twice she brought a blindfold with her and had us use it on her for a short time, on the allegation that it might help her to lose herself.

Of the three really distinct messages which we received, and two of which we illustrate, two are in "gold" and one in a red which is an extremely poor match for the nasturtiums and phlox in use at the moment. More for the general interest of the thing than for any direct bearing it could have after our positive proof of substitution, we examined these cards under the microscope, with the assistance of Mr. L. R. Seidell of the New York Testing Laboratories. Mr. David N. Carvalho, the handwriting expert, had already examined them under a ten-power glass, and had noted that under this glass the fiber of the cards showed no disturbance where it was overlaid by the lines of the writing. On this ground he suggested that the writing might have been done by a transfer process—gelatine or otherwise. High power magnification bore out the observation, but disposed of the inference. The fiber of the cards is not in the least bit disturbed or marked, and most certainly no pen or other hard substance has ever been drawn across them. But the surface shows no trace of gelatine or other transfer substance, so that apparently the words were written or drawn with a soft instrument that would leave no mark. This, of course, means a brush.

Two very different inks were used. Even under a magnification of close to a thousand diameters, the red lines show up as a deposit of fluid substance, perhaps even colloidal. Mr. Carvalho points out that this ink blurs where two strokes cross, a sure sign that it was fluid. The gold, however, under as low a power as twenty, shows distinct and beautiful metallic crystals. These, so far as visual examination can determine, seem to be actually gold rather than bronze or brass. An extremely interesting observation is that here and there, on the red card, one finds isolated crystals of the gold. The gold message was obviously written first, and then the red one with the same brush, imperfectly cleaned. The extreme delicacy of psychic investigation is well illustrated here. In the absence of positive proof that the cards had been substituted, the average psychic believer would regard this microscopic evidence as distinctly indicative of supernormal deposition of the lines of writing!

Two of the cards which we do not illustrate contain gold writing, underlying a leaf pattern in green. One message can be fairly easily made out: "Truth crushed to earth shall rise again," with no signature. The other card, with more difficulty, can be seen to carry the signature "William T. Stead,"

without any message. The leaf pattern on both is quite foreign to the leaves of nasturtium, phlox or aster, the only flowers in use on this day; and the microscope makes it look very much as though brushed on, like the writings.

The fifth card, a picture of which is crowded out, carries in gold a message from Effie, with her signature: "We who love you are doing all we can to establish this truth." This, I think, makes it fair to criticize the messages, *per se*. In telling of the wonderful things which she does "when we aren't looking," the medium gave us to understand that her messages were usually evidential; that they applied to people in the audience often strangers to her, that they were recognized by these people, that the names and sometimes the very signatures of the communicators were verified, etc., etc. Nothing like this, it will be noted, occurred in our presence. All five of our messages were platitudinous atrocities of the worst sort. There is nothing whatever in these texts to contradict the assumption that they were prepared in advance.

To the Genth message a bit of romance adheres. One of the medium's affidavits carries this name. The signer lived in Brooklyn when Mrs. Y knew him, and she informed us that she planned to look him up. When the card came bearing his signature, there was much speculation. Mrs. Y called his residence that evening, according to her statement of next morning, and was informed that he had died several months previously. We were inclined to question the sequence of these incidents.

The medium has made several public or semi-public statements since returning to her home, and in the eye of one who knows all the facts of the sittings and of our dealings with Mrs. Y, these statements suffer severely. Just as an instance, she is quoted as having told her congregation that, on arrival at our office for the first sitting, she was led into the presence of fifteen men smoking cigars, and forced to go through the seance in an atmosphere laden with this smoke. The slender basis of fact for this yarn is that, while the group was gathering for the seance, one gentleman was smoking a cigar. Mrs. Y asked me to stop him, and I did; after which, the commencement of the sitting was delayed for twenty minutes or more, with the windows wide open for ventilation throughout this interval. She also seeks to make capital of the claim that she was "forced," by us, to undergo denudation and examination by a group of strange women. The fact, of course, is that we searched her only when she insisted, and should not have searched her at all had she not insisted. She would do better to stick to facts.

One more point, of some delicacy, must be touched upon. In numerous other instances, investigators who have brought evidence of fraud against mediums have had their findings flung in their teeth, the retort being always that the bare facts are correct, but that the fraud which they imply was committed by the investigators themselves.

I am not drawing upon a disordered imagination when I say that we shall be exposed to this charge; it has already been made, from several quarters. Those who make it, of course, labor under the disadvantage of not having all the facts in their possession, and hence they are apt to single out as their culprit some one of the sitters who never handled the cards, and hence never had opportunity to substitute. But what is a little detail like that, when there is a medium to defend against charges? What matters it to these people that the substituter would have had to be in league with the medium, in order to synchronize his work with her very dramatic behavior at the critical moment? What matters anything, save that another medium has been discredited and must be rehabilitated?

The SCIENTIFIC AMERICAN had anticipated this defense, however, and had done what we could to meet it in advance. In the most celebrated case where the charge of fraud was turned against the investigators, much was made of the fact, duly established, that a number of people in the confidence of the Committee had had more or less free access to the documents. We decided to avoid this error, at least. Accordingly, at no time before or during the seances were any of the cards out of my immediate possession, save when some of them were sent out to be trimmed, when the medium was actually working with them, and when once or twice she herself handed them to Dr. Carrington to be examined, rather than to me. The latter action was entirely outside the agreed-upon procedure, and could not have been an-

ticipated; hence, could not have been taken advantage of. I can, therefore, state without reserve that if substitution were practiced by anybody other than the medium, it was I and I alone, who had the opportunity. That I did have the opportunity goes without saying; the cards were entirely in my custody between and after the seances. We feel that in thus narrowing the possibilities of fraud on our own part, we meet the issue more effectively than by any effort to surround the cards with a system of checking up designed to prevent any tampering with them. It should be simpler to establish that I did not tamper with them, than to establish the effectiveness of any such system. It will now be clear why the first person singular has been employed throughout this narrative to such an otherwise indefensible extent, and why the story revolves so largely about my own movements. Incidentally, if anybody is prepared to believe that I did fake the cards in any way, I don't see that there is anything I can do about it, and I am very certain that there is nothing I want to do about it. I simply present the issue here, so that there can be no mistake about it. The cards were substituted; and if the medium didn't do this, necessarily it was I who did.

Our Committee is under no uncertainty as to who did it, and I can conclude this story no better than by quoting the findings of the sub-Committee which examined Mrs. Y's mediumship. This sub-Committee, consisting of Drs. Prince and Carrington, reports:

"Mrs. Y came before the Committee to produce 'independent writing' on cards supplied by the Committee. This she has failed to do. All writings obtained have been on cards brought into the seance by her and substituted by her for the Committee's cards. The Committee, therefore, rules that she has produced no genuine objective psychic phenomena, and that her claims to their further attention and to the SCIENTIFIC AMERICAN award stand vacated."

### Making Sport a Science

(*Continued from page 398*)

punch of any given power chosen by himself. The observer determines the power of the punch from the reading of a pointer connected with a spiral spring, after which the candidate is expected to perform further punches with as nearly as possible the same intensity, differences between readings indicating the degree of unifo .nity.

Still another apparatus, which is shown in our lower right-hand corner, investigates the sense of touch and rhythm in the case of oarsmen. The observer, seated to the right, indicates by means of a key a given rhythm, which the candidate is asked to imitate or retain as far as possible. The two series of readings, that of the observer and candidate, respectively, are recorded on a drum so as to enable any divergencies to be exactly determined.

Our lower left-hand view shows the experimental arrangement for testing will power in connection with sporting activities, individual courage being the particular quality studied. The candidate is asked to hold in his hand a metal ball into which the experimenter is able unawares to pour hot water. Persons easily frightened and devoid of energy and courage let go most rapidly, with all the symptoms of extreme fright. The apparatus is arranged for locking partly or entirely the supply of hot water to the ball, so that it may be kept cold or lukewarm, as desired.

### The Science of Distribution

(*Continued from page 404*)

was well based, but as affecting whole industries, the opposit ) was the rule.

One striking observation about profits, as shown by the Commission's figures, is that, generally speaking, they follow the trend of the price of raw materials in an inverse ratio. When the farmer gets high prices for his corn, the profit of the corn flakes manufacturer is low; when the farmer sells cheaply, profits to the manufacturer of finished products increases. This appears to be so because such items as cost of manufacture, selling, transportation, overhead, taxes and the like, which enter in the final selling price of an article are pretty well fixed. These costs have shown a steady upward trend (especially taxes, transportation and the cost of manufacture), and to a certain extent are beyond control. The great army of men and women engaged in the business of manufacture, distribution and selling are assured a fairly constant return for effort invested, while the farmer, who contributes

most of the real value of the product, engages in a desperate sort of gamble in values, in which he is often loser.

The fact is, we have outgrown our whole system. We are still doing business by the methods of our grandfathers—the system of barter. This worked fairly well when dealings were between individuals, but today these methods are wasteful and extravagant.

In many instances, also, the machinery for handling agricultural products is woefully inadequate. The Commission found, for instance, that the wholesale district in Chicago was crowded into one narrow street and located without any regard to railroad and shipping terminals. It frequently happened that goods were laboriously carted to this wholesale market from a railroad terminal, sold, and then carted back over the same route and reshipped on the same line. Of course, the consumer paid for this. Happily, this district is now being abolished.

In New York, however, is a situation hardly any better, and with little or no hope for immediate improvement. Few railroads have terminal facilities in the actual city and most of the farm produce which comes in is brought to the docks by lighter and sold at auction on the docks. Out of this have grown some strange practices, which to the layman seem almost inexplainable. For instance, boxed apples, to reach the most favorable market, must have New York Central delivery, while barreled apples must come in by the Erie. One result is that if a buyer wishes both boxed and barreled apples he has to buy at two docks some distance apart and pay two delivery charges.

Such a condition of affairs, it would appear, is not exceptional the country over. A few large cities have taken steps to modernize their marketing and distribution facilities, but outgrown methods still add millions to our bill for necessities.

Another evil which the Commission finds of great importance is the growing tendency on the part of manufacturers of food and other products to extend the scope of their activities beyond the field of manufacture and to engage in distribution. A few years ago the manufacturer dealt only with the wholesaler, who attended to the distribution of his products. Today the manufacturer deals directly with the public, with the result that economy in distribution is forgotten. The aim is rather to secure as *large* a distribution as possible.

The famous orchards of the East, which once furnished most of our fruit, have been neglected and have fallen into disuse, because Western fruit growers have been more energetic in creating a market for their product. Western apples are preferred in New Jersey to the home product, although Jersey apples are far superior in flavor. California prunes are sold in Oregon, where better prunes are grown, because of well advertised excellencies; and Oregon prunes are sold in California for the same reason. It is one of the strange phenomena of this age of advertising that products which have been carted half way around the world are often preferred to better ones which may be had right at hand.

We might go on almost indefinitely pointing out specifically just what is wrong with our system of distribution. The truth is that many things are wrong. Some of them are so obviously wrong that they will undoubtedly be corrected. But the whole picture presented by this report is that of a mad scramble for materials and markets in which many groups, some of which have opposite interests, are engaged. It is a case of every man for himself and charge it to the consumer.

Plainly, some directing influence is needed, but it is also quite plain that the whole system is in such a state of experimentation that it would be difficult to say just what ought or ought not be done. Many of our newest institutions for distribution, although they have achieved great financial success, apparently are chiefly valuable as experiments. Department stores, chain stores, city markets, cooperative markets and like institutions each have points of merit, but their effect on the problem of efficient distribution as a whole is doubtful.

Department stores, for instance, undoubtedly effect great economy by the grouping of many stores under one roof and one management. But the very size of the institution makes it necessary to draw its custom from a wide territory. The expense of advertising to draw this widely scattered trade, and the expense of serving these customers pretty nearly balance the advantage gained.

The chain store has gone to the other extreme and has scattered a number of individual stores throughout the territory served and has cut out all but the most essential services. It is found that no really great economy in operation of the individual stores is obtained, excepting at the expense of service. An interesting development in the chain store idea, however, is the growing tendency on the part of the operators of such stores to assume the rôles of manufacturer, wholesaler and jobber. More and more they are engaging in the manufacture of their own goods, selling under their own trademark. If this idea is carried to its logical conclusion, it may have an important effect.

The chief defect in the retail store, it appears, is that there are too many of them. There is a grocery store in this country for every 72.6 families. This leads to expensive competition between rival stores in the matter of service, furnishings, etc., and is the direct cause of a frightfully large percentage of failures among grocers. The grocery is an extreme example of this evil, but other lines are overcrowded, also. For every 602.7 families there is a men's furnishings store, for every 171.6 families a shoe store, for every 691.5 families a dry goods store, and for every 657.5 families a hardware store.

When it is considered that the larger stores each serve thousands of families, it is difficult to see how the smaller stores can subsist on the patronage left to them. As a matter of fact, they *don't* subsist; hundreds of failures annually help to widen the gap between producer and consumer. For the loss occasioned by every failure somebody must pay—and you may be sure it isn't anybody who is able to pass the charge along. The consumer pays, here as always.

The municipal market has been widely heralded as the instrument which would finally bring the producer and consumer together on common ground, eliminating all of the middlemen and allowing both parties to profit by their mutual exchange. From the standpoint of both producer and consumer the city market is a failure. The producer usually does not care to turn retailer, and when he does, he demands a premium over market price for his goods because they are "fresh from the farm." The truth is that in nearly every city where there are municipal market places, the stands are occupied, not by farmers, but by speculators, either openly or through some subterfuge. The final argument against the city market is that, even if the idea were practical, and all of the available gardening space within hauling radius of our large cities was intensively cultivated to supply these markets, they could supply only a fraction of the foodstuffs consumed in these cities. New York City is unusually well situated as to the proximity of great areas suitable for gardening, and yet it would be possible to raise only about five per cent of the vegetables used in the city on this land. As a matter of fact, the portion of the city's vegetables and food which comes from this source is a negligible portion of one per cent.

The Commission considers that one of the really promising experiments looking toward the more efficient distribution of essential commodities is the farmers' cooperative movement which is sweeping the country. A whole chapter of the report is devoted to this topic. Statistics compiled by the Bureau of the Census show that in 1919, $721,983,639 worth of farm products were sold through cooperative organizations of farmers and that 7.9 per cent of all the farms in the country made sales through such organizations. Purchases through the same organizations in 1919 were $84,615,669. No accurate figures are available since that date, but it is safe to say these probably have been more than doubled since then.

The chief hope in these organizations is that they are centralizing, taking over functions of distribution which heretofore have been intrusted to speculators. They sort and grade their products before sending them to market and thus are making long strides toward standardization of farm products. By owning or controlling storage facilities they prevent dumping of large quantities of a product on the market at one time, a practice to be commended because it assures the farmer a fairer price, saves the consumer from extremely high prices by spreading out over the year the process of distribution, and takes away one of the chief assets of the gambler in foods.

The conclusions drawn in the report are general, rather than specific, as we have suggested. The chief value of the document lies, however, not in the conclusions, but in the facts which it presents. It has given us something to think about and, for the first time, a sound basis for action.

# INDEX TO VOLUME 129

Lack of space makes it impossible to give many cross-references, or to enter a given reference in more than one place. Each article is therefore entered where it is believed it will be most easily found. In every case the general subject should be sought, rather than the supposed specific title of an article; the article may not be indexed under its specific title at all, but may be entered under a statement of what it is about, so that it may the more readily be found by one seeking references to its subject matter. We call special attention to the classifications "Household Appliances," "Machines and Machine Tools," "Machines for Special Purposes," "Tools," etc., under which many items will be found whose location otherwise would be very puzzling. These groups may be examined item by item for a doubtful entry with much greater ease than can the entire alphabet. The individual articles on the chemistry and motor truck pages are indexed separately; the short notes comprising the columns of text on the advertising pages appear only under their column headings. The asterisk (*) indicates that the article in question is illustrated.

## Armor Mats for the Protection of Bank Vaults

IN these days of coined names to identify certain products, the technical writer must needs proceed cautiously lest he give some convenient word or combination of words to an ordinary product only to discover that he has used a registered trademark in vain. A case in point appeared in our October issue, in an article entitled "Protecting Our Great Banks." Therein is a photograph bearing the caption "A 30-inch thick block of steelcrete (concrete and steel) after a laboratory attack lasting only a few minutes, made with modern tools."

Now the truth of the matter is that the caption writer should not have used the word "Steelcrete" in referring to the reinforced concrete block shown in this instance. "STEELCRETE" is a registered trade-mark for a product used for the purpose of reinforcing concrete and for building up "Steelcrete" Armor Mats which are used for the protection of bank vaults. Of course, the name "Steelcrete" was used to signify the usual form of reinforced concrete, without knowledge that such a coined word was a registered trade-mark applying to a definite product. We are very sorry that this error should have occurred.

We are informed by the manufacturers of that product, as well as by affidavit of tests, that it is utterly beyond the scope of any modern implement to cut a man-hole in any properly built concrete wall 30 inches in thickness in a few minutes time, much less a concrete wall containing a "Steelcrete" Armor Mat which type of wall has been pronounced by Government tests to be the strongest and most non-penetrable of all practical forms of vault wall construction.

The great vault in the new building of the Federal Reserve Bank now under construction in New York is protected with "Steelcrete" to the exclusion of the heavy steel laminated metallic plates which have been heretofore used for vault protection. The Bowery Bank vault at 42nd Street, as well as the vault of the Greenwich Savings Bank, Herald Square, are also protected with "Steelcrete."

## Our Abrams Investigation—III

(*Continued from page 392*)

Two main reasons have been given for Dr. X's failure, aside from the fact that his equipment or technique may be at fault, according to many of our correspondents. First, our test, having for its object the differentiation of various pure germ cultures, submitted in vials with labels bearing numbers corresponding to those of a list kept in our possession, was quite unfair. This is news to us. We were assured that the test was quite elementary and certainly the starting point in an investigation having to do with such an involved and amazing technique. Our first move was, and still is, to determine whether germs can be detected and properly tagged by means of a battery of rheostats, a simple wiring arrangement, a human "detector" or reagent, and the skilled electronic practitioner. If we could have such a demonstration to our complete satisfaction, then we could go on to the analysis of the more intricate blood sample. The test seemed fair in advance, and was admitted as fair by Dr. X and his staff. The claim that it is unfair is apparently an afterthought, advanced in the light of the total failure recorded. We cannot permit such untimely alibis in a scientific investigation, else we shall never reach an undisputed conclusion. We discuss this "alibi" more strictly on its merits below.

The second reason given for Dr. X's failure was the faulty performance of the reagent, in an electronic reactions sense. We shall come back to this phase presently.

To discuss the first point, it has been pointed out to us that no electronic diagnostician has ever undertaken a test of this exact nature. That may be so, precisely considered; but we do know that Dr. Abrams supplies small vials containing various germ cultures which are employed for testing the electronic equipment. However, our pure germ cultures, we have been told, were entirely too powerful for the sensitive electronic reactions. The radioactive emanations from these samples were so powerful that they "slopped over" or overran all the different "rates", or wavelengths, if we may use that term for convenience, of the diagnostic equipment. Otherwise expressed, the powerful emanations of the pure germ cultures are out of all keeping with the usual weak emanations of a drop of blood, and it is for the latter situation that the apparatus and technique are designed.

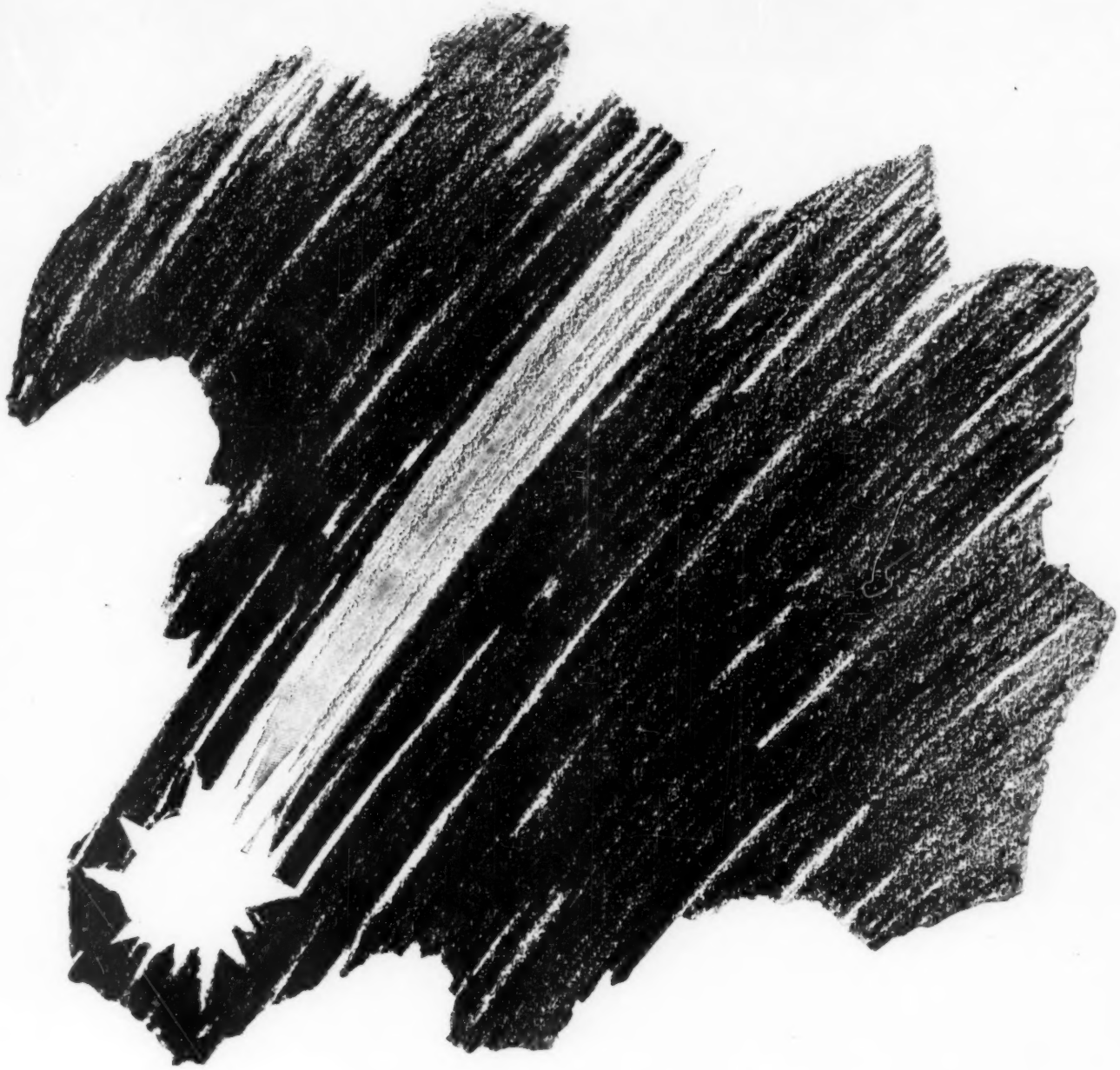
Assuming that these comments are based on fact, then we had a most unfortunate situation for the diagnostician. The pure germ cultures gave out such powerful emanations that their respective "rates" were no longer sharply definable, but overrun or "slopped over" the entire scale of "rates." Thus the diagnostician got reactions for almost everything, as was reported in our November issue. We have a suitable analogy in the case of a receiving set located alongside a powerful spark transmitter. The transmitter may be tuned to 500-meter wave length. The operator of the receiver desires to pick up distant stations of other wave lengths. Yet, no matter how he tunes his receiver, he still gets the 500-meter wave length of the nearby transmitter, and not the weak signals from the distant stations. Powerful radio signals are difficult to tune out, at times.

This explanation for Dr. X's failure sounds logical, as far as it goes. We have still to learn more about the electronic reactions and the relative strength of blood samples and germ cultures before we can pass judgment on this explanation. That the electronic workers mean what they say, we have evidence in the request of another doctor to undergo the same test, with certain modifications. This doctor states that he undertook his own test with pure germ cultures after hearing of our test with Dr. X, and that he had unsatisfactory results. Now he desires to have the pure germ culture vials sheathed with lead, so as to reduce the radioactive emanations, and in this way he believes that it will be possible to reduce the powerful "kick" of the cultures so as to confine them to their respective "rates." It may require several tests to obtain satisfactory readings from the rheostats, since we are dealing with an unusual series of circumstances, so we are told; but the averages from several tests ought to give a determinative result.

The second reason for Dr. X's failure is the faulty performance of the reagent, due to the severe strains imposed by the powerful radioactive emanations of the pure germ cultures. We have been told that reagents are a most variable factor in electronic diagnosis—in truth, it is hoped that the time is not far distant when the reagent's delicate nerves, which give the reactions, may be dispensed with in favor of some mechanical or electrical device.

At any rate, George, the reagent employed by Dr. X in our test, may have been rapidly exhausted by the severe strain of the powerful emanations. Thus, after a few moments his reactions were quite unreliable and therefore worthless. To this suggestion we can only reply that George, on several occasions during our long session, was asked to "short" himself, which he did, and the reactions returned to normal in every instance, indicating to Dr. X's satisfaction that the reagent was still performing satisfactorily. Hence this second reason for Dr. X's failure, which has been advanced by several of our correspondents, is readily disposed of.

The entire electronic reactions matter is an intricate case of wheels within wheels. Our plan of investigation for the present is to learn, first of all, the ability of the electronic diagnostician to differentiate various pure germ cultures, which may be suitably diluted or sheathed or otherwise treated to meet electronic requirements. Then we shall go on to blood samples, checking up the diagnoses with clinical reports. We hope to have diagnoses made of handwriting samples, although we fully appreciate that this phase of electronic work is merely an interesting experiment. Having established what the technique is capable of doing, we shall pass on to a study of the equipment involved and the underlying principles. Perhaps we shall examine the electronic treatment, although for the present the diagnostic feature is a sufficient problem and is more readily susceptible to the routine procedures of scientific investigation.



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